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MACROURID FISHES OF THE SUBGENUS *CHALINURA*, GENUS *CORYPHAENOIDES*, FROM THE INDIAN OCEAN

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ABSTRACT: The subgenus *Chalinura* Goode and Bean, 1883, of the large macrourid genus *Coryphaenoides* Gunnerus, 1765, is represented in the Indian Ocean by six species. *Coryphaenoides grahami* is described from seven specimens from the Indian Ocean, the Atlantic off South Africa, and the Pacific off New South Wales, Australia. Its closest relative appears to be *C. striaturus* Barnard, formerly known only from South Africa, but now known from the southeastern Atlantic across the Indian Ocean into the western Pacific. *Coryphaenoides murrayi* Günther is newly recorded from the Indian Ocean off Australia. Three geographic populations of *C. serrulatus* Günther are recognized: one in the New Zealand area, a second in the Australian Bight, and a third in the central and western Indian Ocean. The last population is described as a new subspecies, *C. serrulatus oceanus*. *Coryphaenoides mcmillani* is described from 16 specimens taken off Cape Agulhas and Whale Ridge in the South Atlantic, the western and central Indian Ocean, off New South Wales and South Australia, and off New Zealand. It most closely resembles *C. subserrulatus* Makushok, a species somewhat peripheral to the Indian Ocean that has been captured only at the extreme southeastern and southwestern margins of the basin, as well as off Argentina and New Zealand.

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INTRODUCTION

Over the past two decades, Soviet fishery and oceanographic expeditions have investigated extensively the continental slope fauna of the Indian Ocean. The resulting biological collections have greatly increased our knowledge of the Indian Ocean deep-sea fauna, which has long remained poorly known. Expeditions in the past have concentrated on the continental margins, with few extending their work to the many geologic features far offshore.

The extent to which Soviet expeditions have helped to fill the gaps in collection sites in the Indian Ocean can be appreciated by comparing the maps in Figures 1 and 2. The benthic trawl and dredge hauls at which macrourids were taken by six different vessels between the late 1800s and the mid-1900s are plotted in Figure 1. Figure 2 shows the sites at which macrourids were collected by Soviet vessels. This map is far from comprehensive, in that the plots represent only those stations at which we have examined ma-

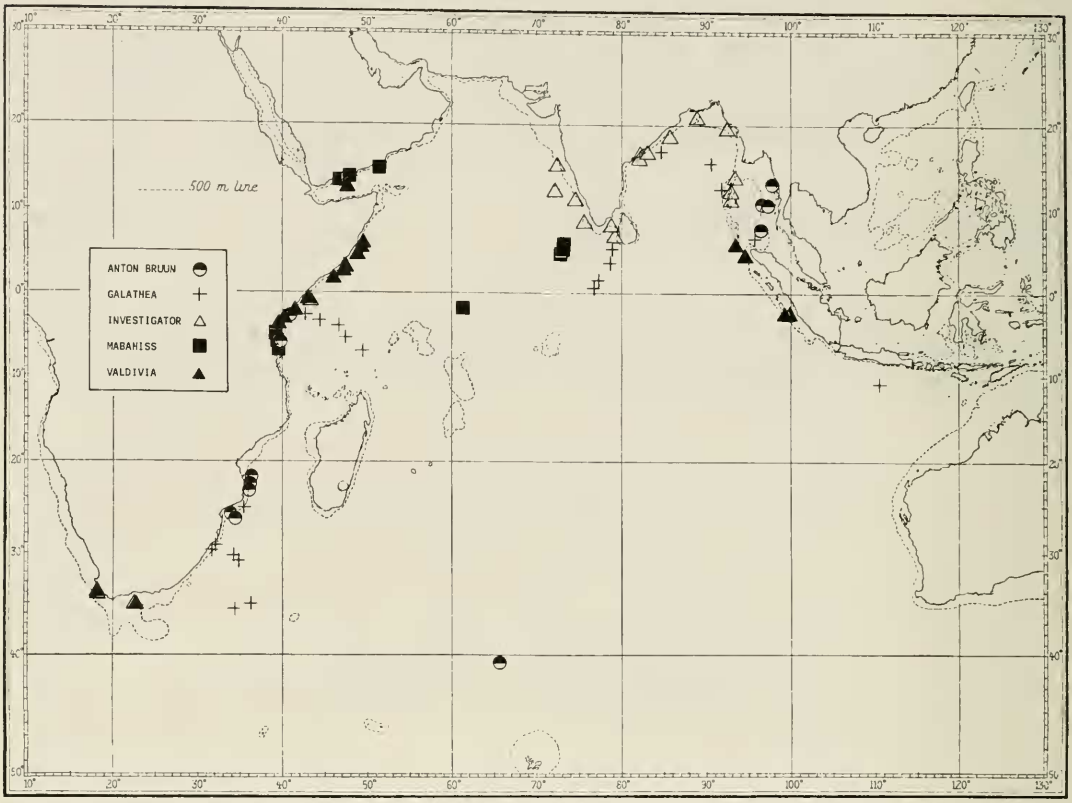

FIGURE 1. Sites at which grenadiers were collected in the Indian Ocean by the ships *Anton Bruun, Galathea, Investigator, Mabahiss,* and *Valdivia.*

crourids. Shcherbachev (1987) provided a map showing general areas in the Indian Ocean where trawling has been conducted by Soviet expedition ships. Conversations with colleagues suggest that collecting along the coasts of southern Africa and Australia by regional fisheries and other scientific agencies has increased considerably in recent years. We have examined some, albeit limited, macrourid specimens accumulated by a few of these entities; those in the Australian Museum (AMS), National Museum of Victoria (NMV), and National Museum of New Zealand (NMNZ) are of particular importance in this report.

Macrourids have been among the most numerous of the fishes collected by the many expeditions at which trawls were dragged at slope depths of the Indian Ocean. Shcherbachev (1987) listed more than 30 species of macrourids (in 21 genera), but based on our studies of collections housed mainly in Moscow, we estimate that the Indian Ocean is home to more than 100 species of macrourids, most in the genera *Coryphaenoides* (about 20 species) and *Coelorinchus* Giorna, 1810 (about 25 species). *Nezumia* Jordan, 1904, and *Ventrifossa* Gilbert and Hubbs, 1920, constitute the next most speciose genera with about 10 species each, with *Gadomus* Regan, 1903, *Bathygadus* Günther, 1878, *Hymenocephalus* Giglioli, 1884, *Mataeocephalus* Berg, 1898, and *Trachonurus* Günther, 1887, having representatives of about three to six species (*Gadomus* and *Bathygadus* may not be grenadiers; see Howes 1989 and Howes and Crimmen 1990). When collections in Australia and South Africa are studied closely, we predict that the total number probably will rise by 10% or more.

This paper is the 11th treating Soviet collections of macrourid fishes of the Indian Ocean. Previous ones include Merrett et al. (1983); Sazonov (1981); Sazonov and Shcherbachev (1982a, b, 1985); Shcherbachev et al. (1986); Shcherbachev (1987); Shcherbachev and Piotrovskyi

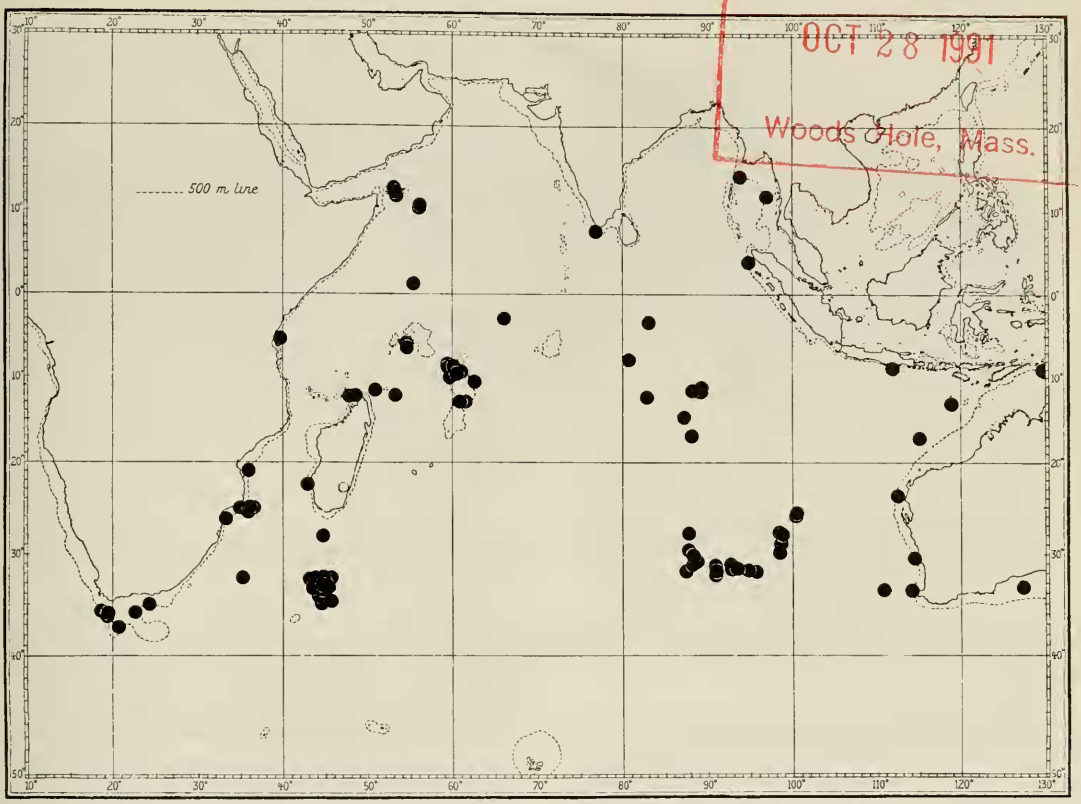

FIGURE 2. Sites at which grenadiers were collected in the Indian Ocean by Soviet vessels.

(1982); Shcherbachev et al. (1979); and Trunov (1980). Iwamoto's participation in this project began with a 3.5-month visit to the P. P. Shirshov Institute of Oceanology in Moscow in 1988, on an invitation from Dr. Nikolai V. Parin, head of the Institute's Laboratory of Oceanic Ichthyofauna. Treatment of the genera *Coryphaenoides* sensu lato and *Coelorinchus* will be by Shcherbachev and Iwamoto. The remaining macrourid genera will be treated jointly by Shcherbachev, Yuri I. Sazonov, and Iwamoto. The purpose of the current paper is to report new collections of four common southern hemisphere species, *Coryphaenoides serrulatus* Günther, 1878, *C. murrayi* Günther, 1878, *C. subserrulatus* Makushok, 1976, and *C. striaturus* Barnard, 1925, and to describe a new subspecies of the first, and two new species related to the last two.

Methods and Materials

Methods for taking and abbreviating measurements and counts follow Iwamoto (1970) and Iwamoto and Sazonov (1988). One difference, however, is the measurement of postorbital length, which in this and subsequent papers is the greatest distance from posterior rim of orbit to upper posterior angle of opercle. Institutional abbreviations follow Leviton et al. (1985), and later, Leviton and Gibbs (1988), except for NZOI, New Zealand Oceanographic Institute, Wellington, which they do not list. Literature references to generic names are not listed in the Literature Cited unless otherwise cited; they can be obtained from Eschmeyer (1990).

Most of the Soviet collections used here are, or will be, deposited in the Zoological Museum of Moscow State University (ZMMGU). Significant representatives have also been deposited in the California Academy of Sciences (CAS). Other collections still in the Shirshov Institute of Oceanology (IOAN) will eventually be deposited in ZMMGU or in other institutions as they are studied. The Zoological Institute of the Academy of Sciences in Leningrad (ZIN) will be the main repository of primary types. Representative sam-

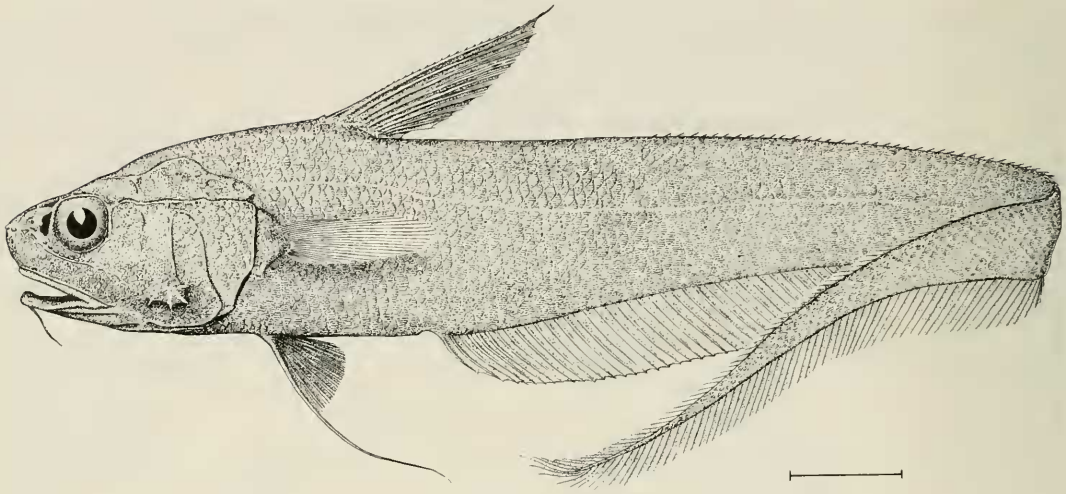

FIGURE 3. *Coryphaenoides grahami* n. sp. Holotype, ZIN 49766, from Broken Ridge (30°58′S, 93°42′E) in the Indian Ocean, 1,060–1,100 m. Scale bar equals 25 mm.

ples will be sent to museums outside the Soviet Union.

Genus *Coryphaenoides* Gunnerus, 1765, sensu lato

The genus (and subgenera) as used here follows definitions given by Iwamoto and Stein (1974) and Iwamoto and Sazonov (1988).

Coryphaenoides grahami new species

(Figs. 3, 4)

Coryphaenoides armatus [non Hector, 1875]: Shcherbachev 1987:7 (listed from Indian Ocean: Madagascar and West Australian ridges, 1,060–1,280 m).

TYPE MATERIAL.—Holotype: ZIN 49766 (unripe ♀, 59.3 mm HL, 390+ mm TL); 30°58′S, 93°42′E; 1,060–1,100 m; *Fiolent* cr. 7(9), tr. 44; 4.VIII.1977. Paratypes: CAS 73237 (unripe ♂, 54.7 HL, 340+ TL); 33°56.8′S, 45°27.8′E; 1,270–1,280 m; *Zvezda Kryma* cr. 6, tr. 90; 31.VII.1976. ZMMGU P-17615 (unripe ♂, 53.2 HL, 337 TL); SE Atlantic off South Africa, 33°36′S, 15°38′E; 1,200–1,225 m; *Poltava* tr. 450 (or 430?). AMS I.29742 (56.0 HL, 340+ TL); off New South Wales, 32°09′S, 153°09′E; 1,079–1,143 m; FRV *Kapala* sta. K-89-1707; 17.VIII.1989. AMS I.29737 (58.2 HL, 347+ TL); off New South Wales, 35°28′S, 150°56′E; 1,116–1,134 m; FRV *Kapala* sta. K-89-1901; 31.VIII.1989. AMS I.29745 (55.5 HL, 367 TL); off New South Wales, 34°54′S, 151°16′E; 1,097–1,143 m; FRV *Kapala* sta. K-89-1802; 22.VIII.1989. AMS I.29798 (55.2 HL, 330+ TL); New South Wales NE of Tuncurry, 33°08′S, 153°16′E; 1,034–1,079 m; FRV *Kapala* sta. K-89-1204; 15.VI.1989.

DIAGNOSIS.—Underside of snout completely scaled; V. 12; teeth small, weak, rather deciduous in most individuals, in a single row in lower jaw; head about 6 in TL; preopercle with 4 spikelike struts.

COUNTS AND MEASUREMENTS (see also Tables 1–4).—D. II,9 (8) + about 100; A. about 110; 1P. i19–i21 (23); scales below 1D. 7.5–9, below mid-base 1D. 5.5–6.5, below 2D. 8–9.5, lat.l. 26–31.

The following in percent HL: pre-A. 159–167; pre-1D. 126–130; pre-V. 101–107; greatest body depth 76–84; depth over A. origin 61–73; length 1P. 60–71; length V. 76–86.

DESCRIPTION.—Body deep behind anal fin origin, gradually tapering into long, laterally compressed tail. Head rather short, broad, its greatest width about equal to postorbital length, its length 6 or more in total length. Vertical diameter of orbit more than horizontal diameter, less than snout length, about 5 in head length. Snout broad, bluntly rounded, scarcely produced beyond large mouth and lacking terminal or lateral scutes. Interorbital broad, width greater than snout length. Mouth subterminal, upper jaw extends to below hind edge of orbit or beyond, rictus extends to below posterior one fourth of orbit. Barbel slender, length about equal to orbit diameter. Suborbital region deep, almost vertical except for narrow crooked suborbital shelf, which is much broader anteriorly than below midorbit. Preopercle with posteroventral margin forming a slight lobe with hind edge inclined forward and

a shallow inflection above angle; preopercle ridge with prominent spikes at posteroventral angle, the spikes formed from the struts that in other species are covered by a bony rounded shield. Interopercle with a slender posterior tip that protrudes slightly beyond preopercle. Sensory pores on head slightly developed, most prominent along ventral margins of snout and suborbital, and along lower jaw. Posterior nostril large, length about equal to diameter of eye lens.

Gill membranes narrowly attached to isthmus, the gill opening extending forward to below hind edge of maxillary. Outer gill slit fairly wide; outer series of rakers on first arch developed, as in most species of subgenus *Chalinura,* into short lappet-like structures; other rakes more ridgelike. Length of gill filaments about two-thirds diameter of orbit.

Scales large and highly deciduous over most of body and head, but those on snout and underside of head much smaller. Entire dorsal and ventral surfaces of snout apparently covered with small scales, without naked lunate patches behind leading edge of snout or a file of small scales along leading edge characteristic of most other species of subgenus *Chalinura.* Scales on underside of snout mostly nonimbricate and beset with 2 or 3 short rows of low spinules. Body scales (Fig. 4) with multiple (as many as 9 or 10) parallel longitudinal rows of short, sharp, recumbent spinules. Head ridges lacking strong stout scales. A row of slightly thickened but very small scales along suborbital ridge, flanked above and below by small, thinner, looser scales.

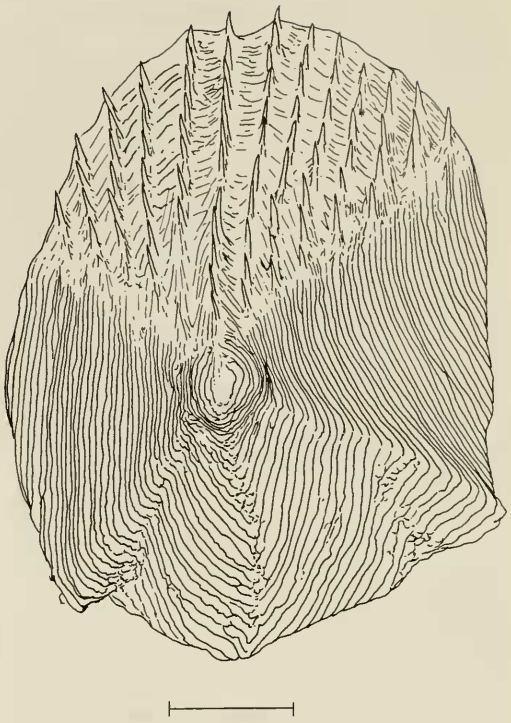

FIGURE 4. Scale from flank (near lateral line) below interspace between first and second dorsal fins of *Coryphaenoides grahami.*

Teeth all small, short, conical, slightly recurved in both jaws. Teeth weak and appear to be infirmly attached to jaws; those on holotype almost entirely missing, and many found lodged in gill rakers of CAS paratype. (In most paratypes

TABLE 1. Gill Rakers Counts in Four Species of *Coryphaenoides.* Asterisks indicate counts of holotype.

	Total gill rakers, first arch												
	Outer series							Inner series					
	7	8	9	10	11	12	13	11	12	13	14	15	16
striaturus	4	6	11	4	3	—	—	—	1	4	21	1	1
grahami	—	1	2	3	—	—	—	1	3	—	2	—	—
mediterraneus	—	—	—	3	2	1	1	—	—	—	—	3	4
murrayi	—	—	2*	—	3	—	—	—	—	—	1*	6	1

	Total gill rakers, second arch											
	Outer series						Inner series					
	11	12	13	14	15	16	11	12	13	14	15	16
striaturus	1	6	15	6	—	—	2	11	12	2	1	—
grahami	1	2	2	1	—	—	1	3	2	—	—	—
mediterraneus	—	—	—	2	3	2	—	—	—	2	3	2
murrayi	—	—	—	2*	2	1	—	1	2*	3	2	1

TABLE 2. Pelvic Fin Ray Counts in Four Species of *Coryphaenoides*.

	Pelvic fin rays			
	10	11	12	13
striaturus	—	4	52	—
grahami	—	12	13	—
mediterraneus	—	—	7	6
murrayi	2	6	5	—

the empty tooth sockets were the only evidence of the former presence of teeth.) Premaxillary teeth in narrow band, scarcely protruding above gum papillae; an outer, widely spaced series of slightly enlarged teeth. Mandibular teeth similarly small and arranged in a single row.

Fins rather well developed; first dorsal high, the serrated spinous ray about equal to head length; outer pelvic fin ray filamentous and extending past anal origin. Pectoral and pelvic origins about on same vertical; first dorsal origin well behind that vertical; anal origin below interspace of first and second dorsal fins, at a vertical passing a short distance behind first dorsal fin; second dorsal origin far posterior.

Ten slender (longest measured 14.8 mm) pyloric caeca in ZMMGU P-17615, an unripe female. Stomach of this individual empty; stomach of CAS paratype everted and could not be examined without damaging specimen.

Color in fresh specimens ivory-white with silvery sheen, edged in different places with black. In alcohol, color fades to dark gray to dark brown, with abdomen and ventral parts of head and gill cover blackish. Lips, gill membranes, mouth, and gill cavities black. Barbel dark brownish basally, pale distally. Paired and first dorsal fins blackish, anal fin dusky.

DISTRIBUTION (Fig. 5).—Known from seven specimens collected in the eastern and western Indian Ocean, the Atlantic off South Africa, and the Pacific off New South Wales, Australia.

SIZE.—To 39 cm.

ETYMOLOGY.—Named for Ken Graham of the New South Wales State Fishery Agency, who has collected numerous valuable fish specimens, including the four AMS paratypes.

REMARKS AND COMPARISONS.—*Coryphaenoides grahami* most closely resembles *C. striaturus*. The two species are apparently sympatric off South Africa and Australia, where two paratypes were discovered among collections of *C. striaturus*. The general shape, counts, and proportional measurements (Tables 1–3) are similar in the two species; the complete scale covering

TABLE 3. Comparison of Preoral Length, Interorbital Width, and Posterior Nostril Diameter in Four Species of *Coryphaenoides*.

	Preoral length (% HL)											
	9	10	11	12	13	14	15	16	17	18	$\bar{x}$	SD
striaturus	—	1	2	9	6	8	6	3	—	1	13.50	1.6987
grahami	—	1	1	2	2	—	1	—	—	—	12.17	1.7224
mediterraneus	1	2	2	2	—	—	—	—	—	—	10.71	1.1127
murrayi	—	—	—	—	1	—	2	—	—	—	14.33	1.1547

	Interorbital width (% HL)													
	23	24	25	26	27	28	29	30	31	32	33	34	$\bar{x}$	SD
striaturus	1	8	9	11	9	11	5	2	—	—	—	—	26.46	1.7474
grahami	—	—	—	—	—	1	2	—	4	—	—	—	30.00	1.1952
mediterraneus	1	—	2	2	1	2	—	—	1	—	—	—	26.56	2.1660
murrayi	—	—	—	—	—	1	2	—	2	—	1	1		

	Posterior nostril (% HL)									
	3	4	5	6	7	8	9	10	$\bar{x}$	SD
striaturus	4	15	20	6	3	—	—	—	4.77	0.9944
grahami	—	—	—	—	—	—	4	1	9.20	0.4472
mediterraneus	1	1	—	—	—	—	—	—	3.50	0.7071
murrayi	1	—	2	—	—	—	—	—	4.33	1.1547

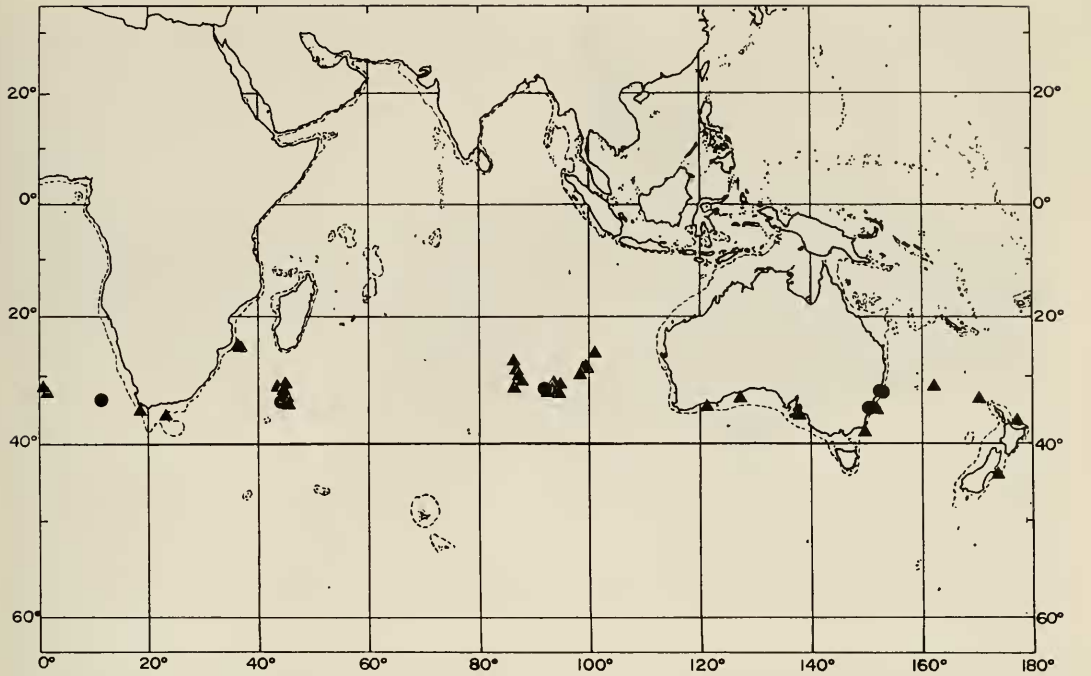

FIGURE 5. Catches of *Coryphaenoides grahami* (circles) and *C. striaturus* (triangles) in the Indian Ocean and adjacent waters.

on the snout, suborbital, and lower jaw contrasts the two from other close members of the subgenus (but not *C. serrulatus*). The new species can be distinguished from *C. striaturus* by its overall darker color; larger posterior nostril (9.1–9.3% HL cf. 3.0–5.5%); slightly broader interorbital (29.3–31.4% cf. 23.0–29.8%); slightly longer distance V.-A. (61–69% cf. 42–62%) and distance isth.-A. (110–119% cf. 90–109%); smaller, weaker teeth; and the spikelike processes on the

TABLE 4. Selected Measurements of Type Specimens of *Coryphaenoides grahami* n. sp.

	ZMMGU P-17515	CAS 73237	AMS I.19798–010	AMS I.29745–005	AMS I.29742–003	AMS I.29737–002	ZIN 49766 (holotype)
TL (mm)	337	340+	330+	367	340+	347+	290+
HL (mm)	53.2	54.7	55.2	55.5	56.0	58.2	59.3
			The following in percent of head length				
Snout	25.0	28.9	26.8	27.6	26.3	28.0	27.0
Internas.	21.4	25.6	21.6	21.4	23.6	23.0	22.9
Interorb.	29.3	31.0	31.2	29.0	28.2	31.4	31.2
Orbit	22.6	23.4	22.6	23.4	22.3	21.0	22.3
Suborb.	11.7	13.2	10.7	13.5	12.5	11.7	13.2
Postorb.	56.4	53.9	56.2	53.9	54.5	56.2	58.0
Orb-preop.	47.6	49.4	46.0	49.2	47.3	48.5	52.6
Up. jaw	41.7	39.1	40.8	40.5	42.9	40.5	42.5
Barbel	19.7	12.8	20.7	17.3+	19.8	22.5	21.6
Gill slit	18.6	16.8	20.1	19.8	20.9	—	20.2
V.-A.	69	69	65	63	64	65	61
Isth-A.	114	119	107	108	109	110	110
1D.-2D.	98+	82	91	95	105	95	94

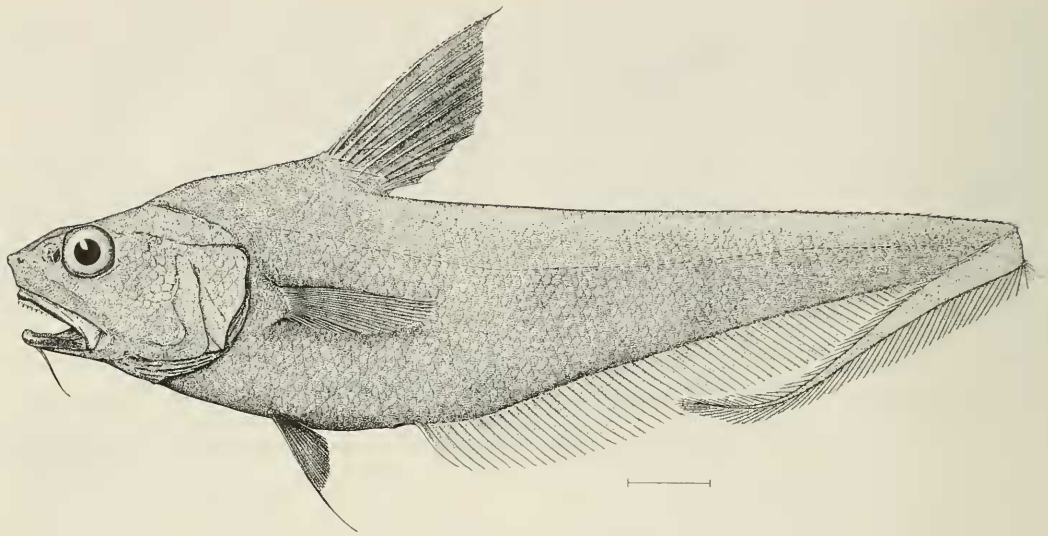

FIGURE 6. *Coryphaenoides striaturus.* Specimen CAS 66471 (79.3 mm HL, 450 mm TL) collected by the *Vityaz'* from Walters Shoals (31°59'S, 45°11'E) in the western Indian Ocean, 1,950–2,050 m.

preopercle. It also differs considerably in the dorsal profile of the head and nape, the latter being much more humped in the larger specimens of *C. striaturus.*

The nearly toothless condition of most specimens was surprising, but Merrett and Karrer (1988) recently documented edentulate specimens of nine adult *Coryphaenoides* referable to *C.* (*Chalinura*) *brevibarbis* Goode and Bean, 1896, *C.* (*Chalinura*) *mediterranea* Giglioli, 1893, and *C.* (*Lionurus*) *carapinus* (Goode and Bean, 1883). These nine specimens were ripe adult males with much enlarged nasal rosettes. We determined the sex of only three specimens of *C. grahami,* but not all had a relatively large posterior nostril (Table 3). The CAS and ZMMGU paratypes are males with moderately developed gonads and well-developed intestines; the holotype is a female. Merrett and Karrer (1988) were unable to offer an explanation for edentulate macrourids. Nor can we.

Coryphaenoides striaturus Barnard, 1925

(Figs. 5–7)

Coryphaenoides (*Chalinura*) *striatura* Barnard, 1925a:500–501 (off Cape Point in 823–1,737 m); 1925b:337–338, pl. 13, Fig. 4, 4a. Iwamoto 1986:335.

Coryphaenoides striatura: Smith 1949:133, Fig. 237. Shcherbachev 1987:7 (in part; listed from Indian Ocean: Madagascar Ridge, Ninety East Ridge, West Australian Ridge; specimens from Naturaliste Plateau, 2,320–2,350 m, represent *C. murrayi*; ZMMGU P-17633).

Coryphaenoides (*Nematonurus*) *armatus*: McCann and McKnight 1980:29–31, Figs. 11, 12 (misidentification of a specimen of *C. striaturus* from sta. E437 off New Zealand, 1,547 m).

Coryphaenoides (*Chalinura*) *murrayi*: McCann and McKnight 1980:34 (in part; specimen from sta. F892; the other specimen is *C. murrayi*).

DIAGNOSIS.—All of snout surfaces uniformly covered with small scales; pelvic fin rays 11–12 (usually 12); premaxillary teeth in broad cardiform band about 4 rows wide, flanked by an outer row of enlarged, slender, widely spaced canines; mandibular teeth irregularly uniserial; orbit diameter 18–24% of HL, interorbital 23–30%, preoral 10–16%; barbel 18–26%; posterior nostril 3.0–7.1%.

MATERIAL EXAMINED.—**Pacific Ocean.** Tasman Sea: ZMMGU P-17616 (65.0 HL, 356 TL); 30°24'S, 161°57'E; 1,210 m; *Dmitry Mendeleev* cr. 16, sta. 1245; 29.XII.1975. Australia: NMV A6569 (49.7 HL, 240+ TL); Victoria, 85 km S of Pt. Hicks, 38°31.4'S, 149°21.5'E; 1,986–1,360 m. AMS uncat. (88.0 HL, 500+ TL); off New South Wales, 34°54'S, 151°16'E; 1,097–1,143 m; *Kapala* sta. 89-1,802; 22.VIII.1989. New Zealand: NZOI (52.7 HL, 325+ TL); E coast of South Is., 42°13.0'S, 174°33.0'E; 1,547 m; sta. F892. NZOI (68.1 HL, 365 TL); N coast of North Is., 36°58.5'S, 176°41.0'E; 1,280–1,196 m. ZMMGU P-17617 (37.1 HL, 231 TL); NW of North Is., 33°56'S, 170°47'E; 2,005–2,010 m; *Dmitry Mendeleev* cr. 16, tr. 1264.

Indian Ocean. South Africa: ZMMGU P-17618 (6, 21.6–32.4 HL, 124–167 TL); 35°44'S, 22°34'E; 1,260–1,350 m; *Ob* cr. 2, sta. 264; 18.III.1957. Mozambique Channel: IOAN (57.0

HL, 295+ TL); 25°28.3′S, 35°28.7′E; 1,260–1,230 m; *Vityaz'* cr. 17, sta. 2629; 23.XI.1988. CAS 66478 (4, 42.3–53.0 HL, 250–302 TL); 25°07′00″S, 36°49′24″E; 2,220–2,140 m; *Vityaz'* cr. 17, sta. 2639; 27.XI.1988. West Indian Ridge: IOAN (51.3 HL, 310 TL); 45°51′S, 41°54′E; 1,700 m; *Fiolent* cr. 5, tr. 121; 28.XI.1974. Madagascar Ridge: ZMMGU P-17619 (2, 38.6–46.7 HL, 240–280 TL); 32°12′S, 43°15.5′E; 1,460–1,470 m; *Prof. Mesiatzev* cr. 7, tr. 135; 14.VI.1979. ZMMGU P-17620 (2, 66.6–76.2 HL, 345+–400 TL); 32°19′S, 44°03′E; 1,210–1,240 m; *Zvezda Kryma* cr. 7, tr. 50; 21.I.1977. CAS 66463 (5, 21.1–71.0 HL, 95+–398 TL); Walters Shoals, 32°53′00″S, 45°11′30″E; 1,310–1,265 m; *Vityaz'* cr. 17, sta. 2672; 9.XII.1988. CAS 66471 (79.3 HL, 450 TL) and IOAN (3, 44.8–57.3 HL, 245+–341 TL); Walters Shoals, 31°59′00″S, 45°11′00″E; 1,950–2,050 m; *Vityaz'* cr. 17, sta. 2772; 25.XII.1988. CAS 66427 (2, 21.0–90.6 HL, 133–493 TL), CAS 66428 (53.6 HL, 303+ TL), and IOAN (3, 23.2–65.3 HL, 149+–334 TL); Walters Shoals, 34°41′48″S, 45°28′00″E; 1,518–1,750 m; *Vityaz'* cr. 17, sta. 2742; 20.XII.1988. IOAN (4, 27.8–65.0 HL, 183–353 TL); 32°45′S, 45°31′E; 1,760–1,700 m; *Vityaz'* cr. 17, sta. 2673; 9.XII.1988. Ninety East Ridge: ZMMGU P-17621 (2, 53.9–82.9 HL, 319–410+ TL) and CAS 71479 (2, 80–87.1 HL, 452+–447+ TL); 27°37.9′S, 87°49′E; *Prof. Mesiatzev* cr. 7, tr. 18; 26.III.1979. ZMMGU P-17622 (37.0 HL, 208+ TL) and CAS 71484 (3, 48.0–69.7 HL, 270+–382 TL); 29°38′S, 88°06′E; 1,300–1,500 m; *Prof. Mesiatzev* cr. 7, tr. 19; 26.III.1979. ZMMGU P-17624 (86.1 HL, 470 TL); 31°50′S, 87°22′E; 1,600–1,624 m; *Prof. Mesiatzev* cr. 7, tr. 21; 29.III.1979. ZMMGU P-17623 (72.4 HL, 430 TL); 30°22′S, 88°43.9′E; 1,320 m; *Prof. Mesiatzev* cr. 7, tr. 20; 28.III.1979. Broken Ridge (West Australian Ridge): IOAN (87.0 HL, 467+ TL); 31°08′S, 88°15′E; 1,380 m; *Ikthyandr* cr. 4, tr. 34. ZMMGU P-17625 (72.7 HL, 412 TL); 30°51′S, 93°46′E; 1,320–1,360 m; *Fiolent* cr. 7(9), tr. 40; 3.VIII.1977. ZMMGU P-17626 (88.0 HL, 505 TL); 28°46.8′S, 98°20′E; 1,270–1,320 m; *Fiolent* cr. 7(9), tr. 36; 25.VII.1977. ZMMGU P-17627 (90.0 HL, 525 TL); 31°09′S, 93°57′E; 1,050 m; *Fiolent* cr. 7(9), tr. 39; 3.VIII.1977. ZMMGU P-17628 (69.3 HL, 340+ TL); 30°58′S, 93°42.3′E; 1,060–1,100 m; *Fiolent* cr. 7(9), tr. 44; 4.VIII.1977. ZMMGU P-17629 (84.3 HL, 470 TL); 31°06′S, 93°49′E; 1,050 m; *Fiolent* cr. 9, tr. 45; 4.VIII.1977. ZMMGU P-17630 (77.1 HL, 430 TL); 25°35.7′S, 100°30′E; 1,624 m; *Prof. Mesiatzev* cr. 7, tr. 43; 19.IV.1979. IOAN (95.0 HL, 510 TL); 31°40′S, 95°37′E; 1,080–1,180 m; *Ikthyandr* cr. 4, tr. 39. IOAN (2, 83.0–85.0 HL, 485–503+ TL); 30°45′S, 94°16′E; 1,425 m; *Ikthyandr* cr. 4, tr. 50. IOAN (2, 83.0–88.0 HL, 460–510+ TL); 30°56′S, 94°42′E; 1,460 m; *Ikthyandr* cr. 4, tr. 51. IOAN (97.0 HL, 550+ TL); 28°38′S, 98°51′E; 1,280 m; *Ikthyandr* cr. 4, tr. 54; 22.III.1978. IOAN (68.9 HL, 390+ TL); 31°08′S, 93°49′E; 1,050 m; *Fiolent* cr. 7(9), tr. 38; 30.VIII.1977. IOAN (2, 46.0–52.0 HL, 260–290 TL); 28°28′S, 98°41′E; 1,260 m; *Fiolent* cr. 7(9), tr. 35; 24–25.VII.1977. IOAN (48.0 HL, 292 TL); 28°39′S, 98°36′E; 1,140 m; *Fiolent* cr. 7(9), tr. 30; 23.VII.1977. Great Australian Bight: ZMUC P-373096 (49.8 HL, 279 TL); 37°28′S, 138°58′E; 1,340–1,320 m; *Galathea* sta. 554; 5.XII.1951. ZMMGU P-17646 (4, 47.5–80.6 HL, 282–447+ TL); 33°48.3′S, 127°17′E; 1,080–1,100 m; *Dmitry Mendeleev* cr. 16, sta. 1373; 28.II.1976. NMV A6197 (81.9 HL, 421+ TL); Western Australia, 34°35.5′S, 121°19′E; 1,015–1,030 m.

South Atlantic Ocean. ZMMGU P-17631 (2, 62.5–72.5 HL, 360–320+ TL); off Namibia (South-West Africa); 1,000 m; *Poltava* tr. 425; 24.I.1970. ZMMGU P-15645 (50.8 HL, 286 TL); 32°41.4′S, 1°48.4′E; 1,060–1,125 m; *Prof. Mesiatzev* cr. 8, tr. 23; 3.IX.1979. ZMMGU P-15644 (57.8 HL, 305 TL); 33°17.7′S, 2°14′E; 923–1,115 m; *Prof. Mesiatzev* cr. 8, tr. 22; 22.IX.1979. IOAN (86.7 HL, 388+ TL); 35°28′S, 18°40′E; 990–1,000 m; *Fiolent* cr. 3, tr. 244; 28.X.1973. ZMMGU P-15656 (91.8 HL, 405+ TL); Discovery Seamount, 1250 m; *Prof. Mesiatzev* tr. 159. ZMMGU P-13879 (2, 67.8–85.6 HL, 330–445 TL); Rio Grande Plateau, 30°25′S, 35°09′W, 1,350 m; *Prof. Mesiatzev* cr. 2, tr. 12; 7.VII.1974; ZMMGU P-17644 (57.5 HL, 306 TL); Rio Grande Plateau; *Zvezda Kryma* cr. 3; ZMMGU P-17645 (92.1 HL, 502+ TL); 30°25′S, 34°04′W; 1,130–1,175 m; *Prof. Mesiatzev* cr. 1, tr. 23; 12.VII.1974. RUSI 10324 (50.4 HL, 254+ TL) and RUSI 10330 (72.5 HL, 400+ TL), no specific locality, but presumably off southern Africa.

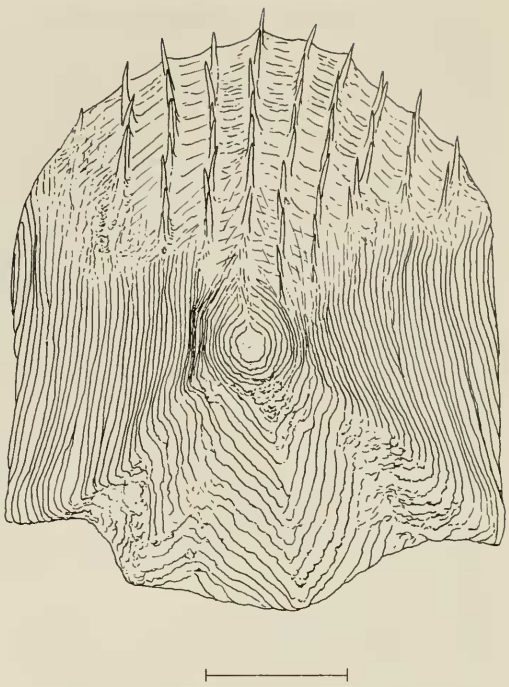

FIGURE 7. Scale from dorsum below interspace of first and second dorsal fins of *Coryphaenoides striaturus*. Scale bar equals 1.0 mm.

COUNTS AND MEASUREMENTS (see also Tables 1–3).—1D. II,8–10 (usually II,9); 1P. i18–i24 (usually i19–i22); V. 11–12 (1 spec. with 13); total GR-I (outer/inner) 7–11/12–16, GR-II 11–14/11–15; scales below 1D. 7.5–10, below mid-1D. 5–7.5, below 2D. usually 8–9, lat.l. usually 30–36; caeca 9–12 (in 15 spec. examined).

Total length 120+–550 mm; HL 21.0–97.0 mm. The following in percent HL: postrostral 70.4–76.5; 26.2–30.2; preoral 10.4–16.3; posterior nostril 3.0–7.1; internasal 19.7–28.3; interorbital 23.0–29.8; orbit 18.2–24.0; suborbital 10.5–14.7; postorbital 50.6–57.2; orbit-preop.

45.7–53.4; upper jaw 38.2–45.8; barbel 18.0–26.4; gill slit 15.5–22.9; V.-A. 42–74; isth.-A. 83–119; depth over A. origin 67–91; 1D.–2D. 63–106; 1D. height 81–109; 1P. 56–68; V. 65–97.

DESCRIPTION.—Body deep, compressed; in most specimens examined, depth at origin of first dorsal fin about equal to head length; depth about half head length over anal fin origin; body tapers gradually from about halfway along length of anal fin, then rather quickly to end of tail. Head rather robust, its greatest width about equal to post-orbital length; its length about 5.5 into total length. A pronounced dip in dorsal profile over orbits, followed by a distinct hump over nape. Orbit small, diameter ¼–⅛ of head length, considerably smaller than snout length. Snout scarcely protruding, rather low, its length about equal to interorbital width or slightly greater; no stout scutelike scales at angles. Head ridges prominent, but not reinforced by stout scales. Mouth large, upper jaw extends posteriorly to below posterior edge of orbit, rictus extends to below midorbit. Chin barbel long and slender, about equal to orbit diameter. Suborbital with a rather broad, pronounced shelf. Preopercle margin slightly inclined posteriorly, forming a moderate, crenulated lobe at angle; interopercle scarcely protruding beyond lobe as a thin, narrow flap; preopercle ridge forming a distinct angle posteroventrally. Sensory pores on head small, inconspicuous; snout surfaces covered with numerous small, low sensory tubercles. Posterior nostrils small, 3.5 or more into orbit.

Gill membranes narrowly attached to isthmus, opercular opening extends forward to below posterior end of lower jaw, slightly behind vertical through hind edge of orbit; no free fold across isthmus. Gill rakers short, lappet-like, distally spinous; outer series of first arch not elongated. Gill filaments moderate in length, longest almost equal to diameter of eye lens.

Body scales (Fig. 7) relatively large, thin, and deciduous. Short, greatly reclined, needlelike spinules arranged in discrete parallel rows, about 9–14 rows, depending on size of fish, in specimens examined. Scales of head generally smaller and with spinules more erect than those on scales of body; scales on snout, suborbital, and underside of head, including mandibular ramus, very small.

Inner teeth of premaxillary in about 4 irregular diagonal rows forming a moderately wide band, flanked by a wide-spaced series of short, slender canine-like teeth. Mandibular teeth consist of a single row of small, erect, spaced teeth.

Second spinous ray of first dorsal fin compressed and armed with sharp, slender, reclined teeth along leading edges, its length about equal to head length; its origin somewhat behind vertical through pectoral and pelvic origins, which are about on same vertical. Outer pelvic ray prolonged into a filament that extends well posterior to anal fin origin, usually to base of 6th–11th anal ray. Anal fin well developed, its origin slightly behind vertical through base of first dorsal fin. Origin of second dorsal fin far posterior, about at distal tip of depressed first dorsal fin; rays scarcely developed over most of anterior half, relatively low over remainder.

Intestinal tract long, with at least 4 major bends. Pyloric caeca numerous, long, slender, directed posteriorly or posteroventrally. Stomach and intestinal tracts of several specimens of *C. striaturus* from Walters Shoals contained remains of bottom-living polychaetes (family Polynoidae), shrimps, gammarids, isopods, crabs, octopods, and cuttlefish (*Heteroteuthis dispar*) (contents determined by I. V. Nikitina and T. A. Gorelova, IOAN).

Color in alcohol overall dark brown to swarthy, although some small to medium-sized specimens of less than 30 cm TL pale to somewhat tawny. Outline of scale pockets in dark specimens quite prominent, but inconspicuous in pale specimens. Head areas, especially snout, mouth, gill covers, and undersides darker in all specimens; a thin, dark orbital rim. Operculum and branchiostegal membranes blackish; lips blackish, but gums pale to gray. Barbel light to medium brown, generally darker near base. Oral, branchial, and abdominal cavities black or dark gray, gill rakers dusky, gill filaments pale. Fins blackish in dark individuals, pale to dusky in pale individuals, although in these latter, outer pelvic ray, uppermost pectoral ray, and membrane between second spinous ray and first segmented ray dark.

DISTRIBUTION (Fig. 5).—Widespread in southern hemisphere, from the Rio Grande Rise in the southeastern Atlantic, to the southern tip of South Africa and the Mozambique Channel, across the Indian Ocean (Madagascar Ridge, Ninety East Ridge, Broken Ridge) to Australia (Naturaliste Plateau, Western Australia, Victo-

ria, New South Wales) and into the Pacific in the Tasman Sea and off New Zealand. Depth range 823–2,010 m, although most captured between 1,000–1,400 m.

Size.—To at least 55 cm TL and 97 mm HL.

Remarks and Comparisons.—*Coryphaenoides striaturus* had been poorly known and recorded from only two specimens (Iwamoto 1986) until our examination of Soviet collections from the Indian Ocean and others in Australian and New Zealand museums. The species is actually abundant and widespread in slope waters at depths of 1,000–1,400 m.

Coryphaenoides striaturus is very similar to *C. mediterraneus* (Giglioli, 1893) of the North Atlantic, but the two are immediately distinguished by differences in the snout squamation: *C. mediterraneus* is completely naked on the underside of snout and has lunate naked patches above; *C. striaturus* is completely scaled in those areas. Pelvic fin ray counts are somewhat higher in *C. mediterraneus,* 12–14 (compared with 11–12). *Coryphaenoides mediterraneus* also appears to grow considerably larger, attaining at least 670 mm TL and 129 mm HL (ZMMGU uncat. from off northwestern Africa, 22°40′N, 17°20′W, 1,370–1,430 m), compared with the maximum of 550 mm TL and 97 mm HL of specimens of *C. striaturus* we have examined.

Coryphaenoides murrayi is another closely related congener that has also been captured in the Indian Ocean, as well as off New Zealand, where a specimen of *C. striaturus* was identified by McCann and McKnight (1980) as *C. murrayi.* The almost completely naked snout of that species (but a characteristic row of small scales along leading edge) readily distinguishes specimens of *C. murrayi* from those of *C. striaturus. Coryphaenoides murrayi* also has a slightly larger and higher snout (length 29–31% HL, preoral length 11–17%), somewhat broader interorbital width (28–34%) and suborbital (13–17%).

McCann and McKnight (1980) erroneously identified a specimen of *C. striaturus* as *C. armatus,* but that species is readily distinguished by its naked underside of snout, premaxillary teeth broadly conical and in one or two rows, shorter barbel (11–15% HL), body scales with a slightly enlarged median spinule row, scales of head stouter, more adherent, sensory pores well developed and prominent, and snout more protruding and pointed.

Coryphaenoides murrayi Günther, 1878
(Fig. 8)

Coryphaenoides Murrayi Günther, 1878:26 (E of New Zealand, *Challenger* sta. 168, 1,100 fm [2,012 m]); Gilbert and Hubbs 1916:143. *Macrurus* (*Chalinurus*) *murrayi*: Günther 1887: 144, pl. 34A.

Chalinura murrayi: Goode and Bean 1896:412; Grey 1956: 170 (in part; records).

Coryphaenoides (*Chalinura*) *murrayi*: McCann and McKnight 1980:32, Figs. 14–16 (in part; specimen from sta. F126; the other specimen is *C. striaturus*).

Diagnosis.—All ventral and most dorsal surfaces of snout naked; a naked strip behind leading horizontal edge of snout on each side; pelvic fin rays 11–12 (usually 12); premaxillary teeth in broad cardiform band about 6 rows wide, flanked by an outer row of enlarged, slender, widely spaced canines; mandibular teeth uniserial; snout 28–31% of HL, interorbital 28–34%, orbit 20–23%, barbel 23–26%, outer gill slit 20–22%.

Material Examined.—BMNH 1887.12.7.113 (Holotype; 62.6 mm HL, 373 mm TL); off New Zealand; 2,012 m; *Challenger* sta. 168. ZMMGU P-17633 (2, 28.5–61 HL; 175–324 TL) and CAS 73238 (35.5 HL, 187 TL); 33°42′S, 110°53′E; 2,320–2,350 m; *Dmitry Mendeleev* cr. 16, sta. 1388. LACM 10978 (4, 26.5–48.0 HL, 110+–265 TL); W of Auckland Is., 51°07′S, 162°03′E; 1,665 m; 10-ft Blake trawl; 8.II.1965. NZOI (73 HL, 365 TL); N of North Is., New Zealand, 36°58.5′S, 176°41.0′E; 1,280–1,196 m. NMV A6793 (200 TL); 85 km S of Pt. Hicks, Victoria, Australia; 38°31.4′S, 149°21.1′E; 1,986–1,360 m.

Counts and Measurements (see also Tables 1–3).—1D. II,8–10; 1P. i18–i20; V. 10–12; total GR-I (outer/inner) 9–11/14–16, GR-II 14–16/12–16; scales below 1D. 9–11, below mid-1D. 6–7, below 2D. 9–11, lat.l. about 33.

Total length 110–373 mm; HL 26.5–62.6 mm. The following in percent HL: postrostral 73–75.4; snout 28.3–29.6; preoral 11–17; internasal 19.7–34.0; posterior nostril 4.6–5.3; interorbital 28.9–33.3; suborbital 13–17; postorbital 53–60; orbit-preop. 49–57; upper jaw 42–45; V.-A. 45–56; isth.-A. 87–100; body depth 79–84; depth over A. 63–71; 1D.-2D. 34–81; 1D. height 77–91; 1P. 60–71; V. 87–101.

Description (mostly of holotype, supplemented by other specimens).—Trunk rather short, distance isthmus to origin of anal fin usually less than length of head. Head relatively broad, greatest width almost two-thirds its length. Snout broad, blunt, subvertical. Orbits small, about 1.5 into snout, 1.5 into broad interorbital space, 5.0 into head length. Mouth large, almost

FIGURE 8. Photograph of holotype of *Coryphaenoides murrayi*, BMNH 1887.12.7.113 trawled by the *Challenger* east of New Zealand in 2,012 m. Photograph by Geert Brovad.

terminal; upper jaw extends to below posterior margin of pupil. Suborbital region wide, subvertical, weakly ridged. Barbel slender, slightly longer than orbit diameter. Anterior nostril free, septum separating anterior and posterior nostrils not forming a hood. Preopercle somewhat lobelike, its vertical margin steeply oblique, posteroventral margin crenulated, with tips of interopercle and subopercle slightly exposed beyond.

Gill openings wide, membranes of opposite sides join on isthmus below posterior margin of orbits, about at vertical of posterior end of maxillary. Gill rakers and filaments about as described for those of *C. striaturus*.

Head mostly covered with scales, but naked on lips, gill membranes, nasal fossae, underside of snout, and ventrally on anterior portion of suborbital; a single transverse row of small, embedded scales marking leading edge of snout, behind which is a narrow, naked strip; mandibles finely scaled posteriorly, but naked at anterior end. Head scales with low, small spinules arranged in 3–6 divergent rows; those on body with 5–8 weakly divergent to parallel rows.

Teeth prominent, an outer enlarged row (18 + 20 teeth in holotype) on premaxillary, medial to which is a broad, tapered band of villiform teeth, about 6 rows wide at symphysis, 2 wide posteriorly. Mandibular teeth in a single row (19 + 21 teeth in holotype).

Length first dorsal fin less than length of head; the first ray a short sharp spike, the second ray spinous, armed along leading edge with short, sharp, reclined teeth; fin origin well behind those of pectoral and pelvic fins; second dorsal poorly developed, its origin often indistinct and far posterior to first dorsal base. Pectoral fin about three-fifths of head length, origin about on same vertical as that of pelvic fin. Outer pelvic ray prolonged, about equal to head length in some

specimens, extended posteriorly about to base of 6th–12th anal fin ray. Anal origin below hind end of first dorsal fin base.

Holotype with 9 long pyloric caeca, the longest caecum measuring about 27 mm. In small (110+ mm TL) specimen from LACM 10978, longest of 10 flaccid caeca measured only 3 mm. Swimbladder of holotype (already dissected out when examined in October 1986) had six thin retia, each tipped with a small peltate gas gland.

Color in alcohol light to medium brown; mouth bluish brown; gill cavity dark brown, lips and all rays yellowish brown to grayish brown.

Distribution.—Western Indian Ocean to southern Australia, New Zealand, and Fiji, in depths of 1,196–2,350 m.

Size.—To at least 37 cm.

Remarks and Comparisons.—The Indian Ocean collections here reported are the first records from waters west of New Zealand. The type series apparently included five specimens, but only two were examined in BMNH, the putative holotype and a single 129+ mm TL paratype that represents a specimen of *C.* (*Lionurus*) *carapinus* (Goode and Bean, 1883). The holotype is in good condition, and salient diagnostic features are readily apparent. The illustration given in Günther (1887: pl. 34A) is excellent and accurate.

The species was confused in the past with *C. mediterraneus* (Giglioli, 1893), but that species has more pelvic fin rays (13–14, rarely 12), a longer barbel (27–37% HL), a slightly shorter snout (25–29% HL), and perhaps a slightly narrower band of premaxillary teeth (4–5 rows wide) (see Marshall 1973:593–595). The widespread *C. leptolepis* (Günther, 1887) is closely similar, but has somewhat fewer pelvic fin rays (9–11), shorter barbel (16–23% HL), and longer outer gill slit (23–28% HL). See the description of *C. striaturus* for a comparison with that species.

Coryphaenoides serrulatus Günther, 1878

Coryphaenoides serrulatus Günther, 1878:26 (type locality NE of New Zealand, *Challenger* sta. 169, 700 fathoms; 3 specimens). Whitley 1968:38. Ayling and Cox 1982:165. Last et al. 1983:243, Fig. 21.17 (description; Tasmania and Victoria, Australia). Paxton et al. 1989:326 (Australian records).

Macrurus (*Macrurus*) *serrulatus*: Günther, 1887:133, pl. XXX, Fig. A.

Macrourus serrulatus: Phillipps 1927:22.

Coryphaenoides (*Coryphaenoides*) *serrulatus*: McCann and McKnight 1980:37–39 (description; New Zealand records).

Diagnosis.—Seven pelvic fin rays; large, prominent, spiny scutes at terminal and lateral angles of snout; spinules on body scales leaf-shaped or lanceolate; outer gill rakers relatively long and somewhat tablike; a well-developed chin barbel.

Remarks.—We have been able to distinguish three populations of the species: one confined to oceanic areas of the Indian Ocean; another to the Australian Bight; and the last to the western South Pacific in the Tasman Sea and off New Zealand. The first population in the Indian Ocean is here recognized as a new subspecies and is readily distinguished from the nominate subspecies from the western Pacific. The population in the Australian Bight area appears to be intermediate in most of the characters that separate the populations on either side (Tables 5, 6; Fig. 9). It thus suggests that the Australian Bight may be an area of intergradation. The distributions of character states generally follow a steplike progression, with the Australian Bight population intermediate. In three characters (distance from orbit to angle of preopercle, interorbital width, and counts of gill rakers), however, the Australian Bight population is skewed away from the others—suggesting that perhaps it, too, deserves subspecific recognition. Our recognition of subspecies serves to highlight the geographical differences we found in the species. It is beyond the scope of the present work to pursue this problem further, but it is worthy of closer study by persons having access to material from along the entire continental slope of Australia.

Coryphaenoides serrulatus serrulatus Günther, 1878

(Figs. 9, 10)

Diagnosis.—Outer pelvic ray 50–80% of HL, usually falling near or slightly beyond origin of anal fin, but seldom beyond base of fifth or sixth ray. Orbit diameter (30) 32–36 (37%) of HL, suborbital 11–13 (14)%, upper jaw (39) 40–44%, barbel (20) 21–26 (28, 30)%, orbit to angle of preopercle 37–45 (47)%. Inner gill rakers first arch (total) 11–13 (14).

Material Examined.—**Pacific Ocean.** New Zealand: ZMMGU P-17634 (53.0 mm HL, 286+ mm TL); 43°35′S, 161°25′W; 670 m; *Kamenskoe* tr. 31; 16.VII.1978. ZMMGU P-17647 (61.5 HL, 353 TL); 43°04′S, 175°17′E; 810 m; *Poseidon* tr. 99 ("122E"). ZMMGU P-17648 (2, 45.3–68.0 HL, 242+–330+ TL); 43°05′S, 174°56′W; 900 m; *Poseidon* tr. 100

TABLE 5. Frequency Distributions of Selected Proportional Measurements for Three Populations of *Coryphaenoides serrulatus*.

	Preoral length (% HL)								
	12	13	14	15	16	17	18	$\bar{x}$	*SD*
Indian Ocean	2	7	10	13	12	3	–	14.74	1.2933
Australian Bight	1	3	3	7	7	2	2	15.20	1.5275
New Zealand	–	1	1	1	4	2	1	15.80	1.4757

	Interorbital width (% HL)								
	18	19	20	21	22	23	24	$\bar{x}$	SD
Indian Ocean	–	9	12	11	6	1	1	20.52	1.2192
Australian Bight	–	–	1	4	5	1	1	21.75	1.0553
New Zealand	1	7	8	5	1	–	–	19.91	0.9714

	Greatest orbit diameter (% HL)												
	27	28	29	30	31	32	33	34	35	36	37	$\bar{x}$	SD
Indian Ocean	4	2	10	10	11	8	3	–	–	–	–	30.21	1.6106
Australian Bight	–	–	–	–	–	4	7	6	6	3	1	34.00	1.3868
New Zealand	–	–	–	1	–	1	5	–	1	2	–	33.40	1.8379

	Suborbital width (% HL)							
	10	11	12	13	14		$\bar{x}$	SD
Indian Ocean	14	21	9	1	–		10.93	0.7804
Australian Bight	–	3	12	11	1		12.37	0.7415
New Zealand	–	2	6	1	–		11.89	0.6009

	Barbel length (% HL)														
	20	21	22	23	24	25	26	27	28	29	30	31	32	33	$\bar{x}$	SD
Indian Ocean	–	–	–	1	2	8	8	7	2	6	3	–	1	1	27.00	2.2243
Australian Bight	–	–	–	1	3	–	2	–	1	–	1	–	–	–	25.63	2.3867
New Zealand	1	2	1	1	1	3	–	–	–	–	–	–	–	–	22.89	1.9650

	Orbit to angle of preopercle (% HL)													
	37	38	39	40	41	42	43	44	45	46	47	48	$\bar{x}$	SD
Indian Ocean	–	–	–	–	2	6	13	13	10	1	–	1	43.67	1.3342
Australian Bight	3	3	6	3	3	5	–	1	1	–	–	–	40.04	2.1307
New Zealand	–	–	–	1	5	1	1	1	–	–	1	–	42.10	2.0790

	Upper jaw length (% HL)									
	39	40	41	42	43	44	45	46	$\bar{x}$	SD
Indian Ocean	–	1	1	11	16	10	6	1	43.20	1.2040
Australian Bight	1	2	5	6	5	2	–	–	41.86	1.3148
New Zealand	1	3	6	–	–	–	–	–	40.50	0.7071

("87E"). ZMMGU P-17649 (86.3 HL, 445+ TL), *Poseidon* (no trawl number) ("173E"). ZMMGU P-17650 (90.1 HL, 440+ TL); *Poseidon* (no trawl number) ("176E"). ZMMGU P-17651 (70.7 HL, 386 TL); 42°51′S, 177°49′W; 1,050 m; *Poseidon* tr. 97; 8.II.1978. ZMMGU P-17652 (59.5 HL, 340 TL); 52°33′S, 171°35′E; 540 m; *Poseidon* tr. 155 ("92E"). ZMMGU P-17635 (2, 60.5–63.1 HL, 342–360 TL); 43°01′S, 174°22′E; 850–860 m; *Dmitry Mendeleev* cr. 16, sta. 1268. Australia: AMS I.24054-013 (318 TL); New South Wales off Kiama, 34°39′S, 151°18′E; 869 m; 1983.

Indian Ocean. Great Australian Bight: ZMMGU P-17653 (24, 68.2–82.1 HL, 235+–449 TL); 33°48′S, 127°17′E; 1,080–1,100 m; *Dmitry Mendeleev* cr. 16, sta. 1373; 28.II.1976. NMV A.3400 (3, 61.5–69.0 HL, 341+–370 TL); off Portland, Victoria, 38°38′S, 141°04′E; 990–1,100 m. Tasmania: AMS I.25477-001 (69.0 HL, 365 TL); W coast off Pieman R.

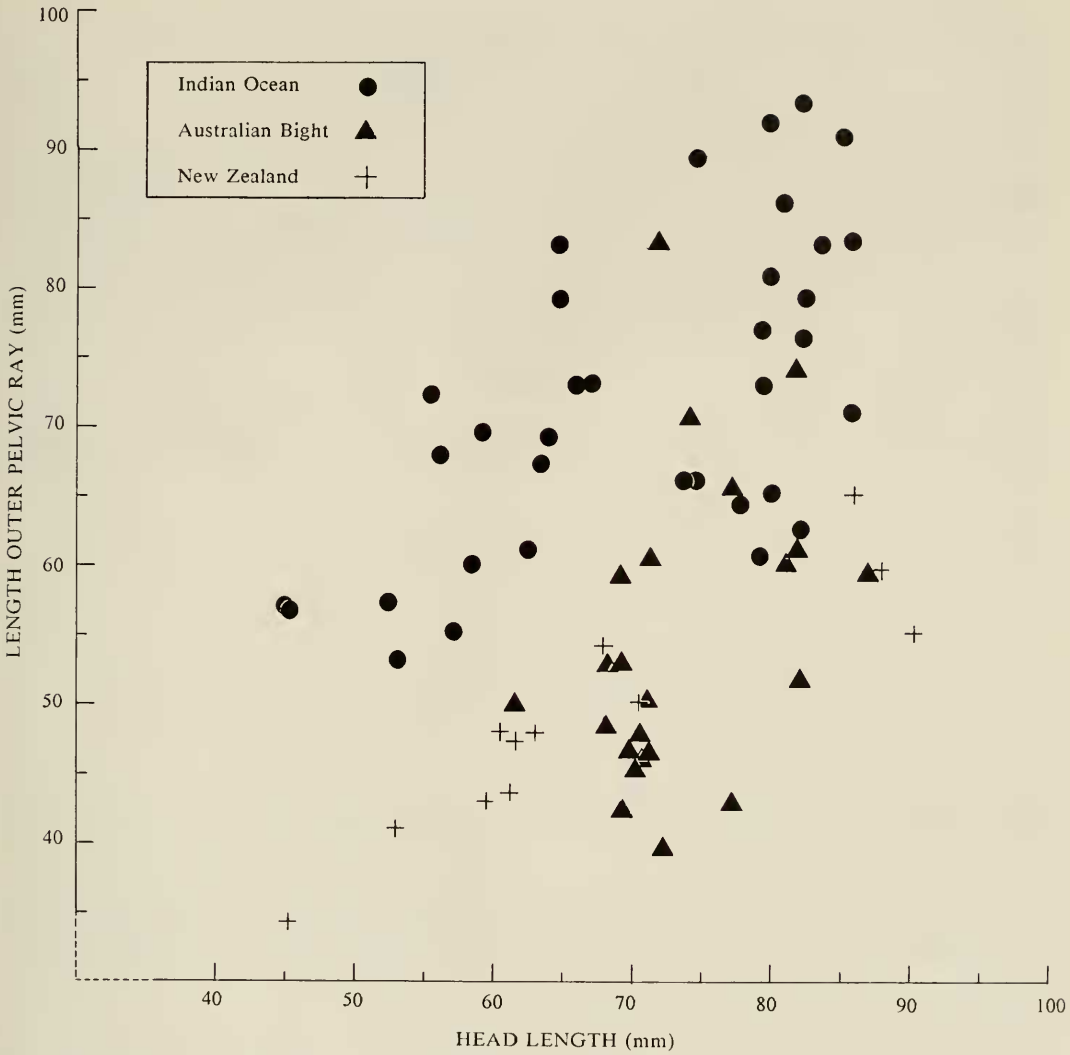

FIGURE 9. Scatter diagram showing relationship of length of outer pelvic fin ray to head length in three populations of *Coryphaenoides serrulatus*.

DISTRIBUTION (Fig. 10).—Off New Zealand, in the Tasman Sea off New South Wales, Australia, in the Indian Ocean off Tasmania and the Great Australian Bight, in depths of 540–1,100 m.

REMARKS AND COMPARISONS.—Specimens from New Zealand and the Tasman Sea tended to be more uniformly brown and paler than the darker, violet-hued subspecies from the Indian Ocean, the scale pockets and the suborbital ridge were not as prominently delineated, and the scales were somewhat more adherent. Most specimens from the Australian Bight were in poor condition, and several important characters (such as barbel length and length outer pelvic ray) could not be properly measured. The consequence of this is apparent in the wide dispersion of points in the scatter diagram (Fig. 9). When evaluating this diagram, one should consider the maximal proportional lengths plotted for each population as having greater import, because the shorter lengths usually represent measurements of broken fin rays. Bearing this in mind, the New Zealand specimens appear to have a distinctly shorter outer pelvic fin ray.

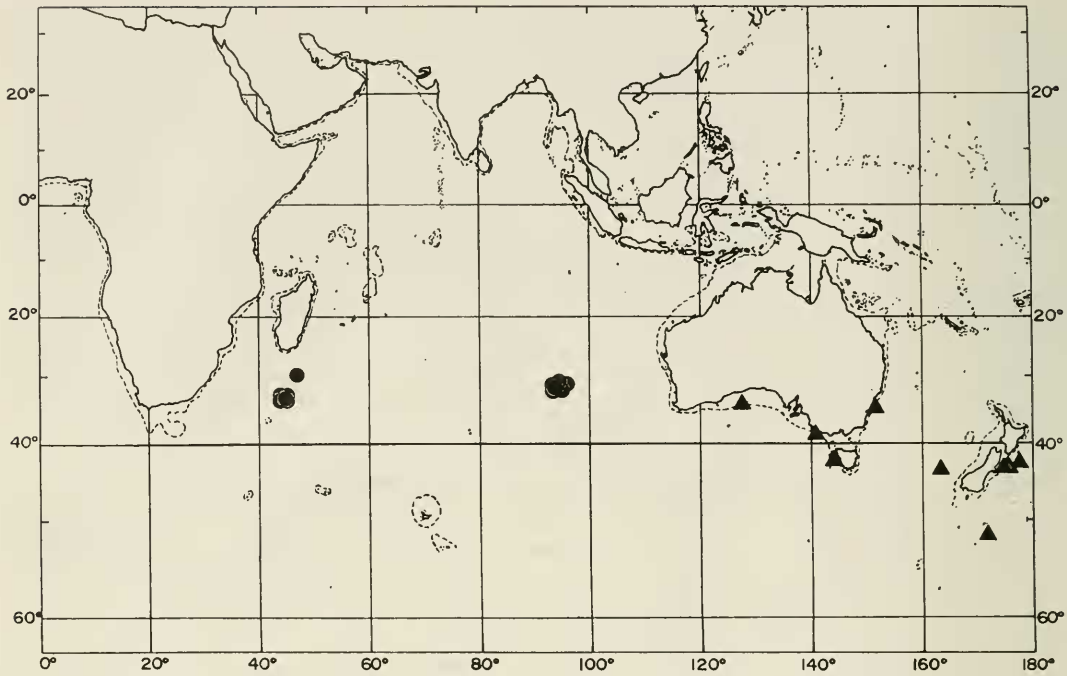

FIGURE 10. Catches of *Coryphaenoides serrulatus oceanus* (circles) and *C. s. serrulatus* (triangles).

Coryphaenoides serrulatus oceanus new subspecies

(Figs. 9–11)

Coryphaenoides serrulatus: Shcherbachev 1987:41 (listed from Indian Ocean: Madagascar Ridge and West Australian Ridge [=Broken Ridge]; 870–1,250 m).

DIAGNOSIS.—Outer pelvic fin ray 85–120% HL, extends well beyond anal fin origin, usually to about 8th–16th anal ray. Orbit diameter (27) 29–33% of HL, suborbital 10–12 (13)%, upper jaw 42–45 (46)%, barbel (23) 25–30%, orbit to angle of preopercle (41) 42–45 (48)%. Inner gill rakers on first arch (total) (12) 13–14 (15).

MATERIAL EXAMINED.—Holotype: ZIN 49797 (88.5 mm HL, 482+ mm TL); Walters Shoals, 33°01′S, 44°30′E; 970–980 m; *Vityaz*' cr. 17, sta. 2706; 15.XII.1988. Paratypes: Broken Ridge (West Australian Ridge): ZMMGU P-17636 (57.1 mm HL, 358 mm TL); 31°10′S, 93°56′E; 1,120–1,250 m; *Fiolent* cr. 7(9), tr. 39; 3.VIII.1977. ZMMGU P-17637 (2, 52.5–77 HL, 308–437+ TL); 31°09′S, 93°49′E; 1,050 m; *Fiolent* cr. 7(9), tr. 38; 3.VIII.1977. ZMMGU P-17639 (83.6 HL, 465 TL); 31°32.5′S, 95°16′E; 1,050 m; *Zvezda Kryma* cr. 6, tr. 133; 19.IX.1976. ZMMGU P-17640 (5, 53.2–67.0 HL, 305–391 TL); 30°59′S, 93°35′E; 1,050 m; *Fiolent* cr. 7(9), tr. 43; 4.VIII.1977. ZMMGU P-17641 (52.4 HL, 371 TL); 31°06′S, 93°49′E; 1,050 m; *Fiolent* cr. 7(9), tr. 45; 4.VIII.1977. IOAN (6, 53.1–74 HL, 292–385 TL); 31°03′S, 93°08′E; 1,049–1,064 m; *Prof. Mesiatzev* cr. 7, tr. 26; 2.IV.1979. IOAN (4, 75.7–85.4 HL, 407–477 TL); 31°04′S, 95°38′E; 1,000–1,120 m; *Ikthyandr* cr. 4, tr. 38. IOAN (2, 78.5–84.6 HL, 422–485 TL); 30°59′S, 93°35.7′E; *Ikthyandr* cr. 4, tr. 48; 17.III.1978. IOAN (2, 78.4–82.5 HL, 425–480 TL); 30°45′S, 94°16′E; 1,255 m; *Ikthyandr* cr. 4, tr. 49. Madagascar Ridge: ZMMGU P-17638 (55.6 HL, 337 TL); 33°08′S, 44°15′E; 870–888 m; *Fiolent* cr. 11, tr. 18; 14.IV.1979. ZMMGU P-17654 (81.0 HL, 480+ TL); 30°02.8′S, 46°02.5′E; 960–1,010 m; *Zvezda Kryma* cr. 1(6), tr. 13; 2.VII.1976. ZMMGU P-17655 (81.7 HL, 420 TL); 32°19′S, 44°03′E; 1,210–1,240 m; *Zvezda Kryma* cr. 7, tr. 50; 22.I.1977. IOAN (2, 47.5–72.2 HL, 266–392 TL) and CAS 66468 (7, 57.6–71.0 HL, 332–415 TL); 33°01.2′S, 44°36.8′E; 1,010 m; *Vityaz*' cr. 17, sta. 2668; 8.XII.1988. IOAN (2, 71.0–88.5 HL, 402–480+ TL) and CAS 66432 (80.2 HL, 450 TL); 33°01′00″S, 44°30′00″E; 970–980 m; *Vityaz*' cr. 17, sta. 2706; 15.XII.1988. IOAN (2, 28.8–50.5 HL, 158+–294 TL) and CAS 66464 (56.1 HL, 282+ TL); Walters Shoals, 33°16′42″S, 43°41′00″E; 920–900 m; *Vityaz*' cr. 17, sta. 2764; 24.XII.1988. IOAN (38.6 HL, 234 TL) and CAS 66481 (45.3 HL, 290 TL); Walters Shoals, 33°01′48″S, 44°23′36″E; 910–925 m; *Vityaz*' cr. 17, sta. 2707; 15.XII.1988. IOAN (20, 35.3–65.8 HL, 213–388 TL); Walters Shoals; *Vityaz*' cr. 17, sta. 2765; 24.XII.1988.

COUNTS AND MEASUREMENTS (see also Tables 5, 6).—D. II,9–11 + 112–119; 1P. i18–i24 (usually i19–i22); V. 7; total GR-I (outer/inner) 8–11/12–15 (usually 13 or 14), GR-II 12–15/10–15 (usually 13 or 14); scales below mid-1D. 5.5–7.5, below 2D. 7–10, lat.l. 35–41; caeca 14–23.

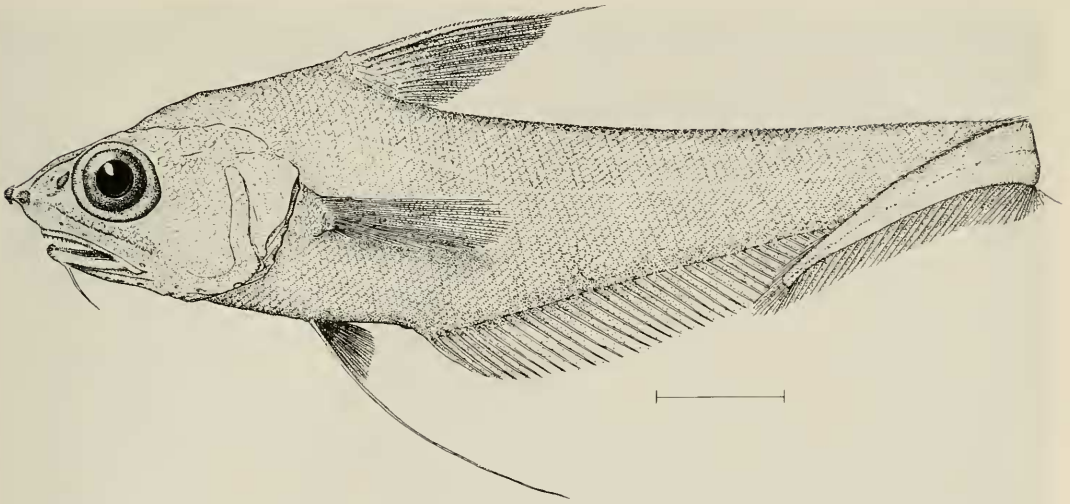

FIGURE 11. *Coryphaenoides serrulatus oceanus* n. subsp. CAS 66464 (56.1 mm HL, 282+ mm TL) collected by the *Vityaz'* from Walters Shoals in the western Indian Ocean, 920–900 m. Scale bar equals 25 mm.

Total length 158+–485 mm, HL 26.8–88.5 mm. The following in percent HL: postrostral 72.4–76.2; snout 26.3–30.5; preoral 11.5–16.8 (usually 13–15); internasal 16.2–18.8; posterior nostril 6.2–9.2; interorbital 18.6–24.0 (usually 19–22); orbit 26.8–33.0 (usually 30–32); suborbital 9.5–12.1; postorbital 43.0–49.5; orbit-preop. 40.9–47.4 (usually 42–45); upper jaw 40.5–46.4; barbel 23.3–33.4 (usually 25–29); gill slit 16.1–22.7; pre-A. 148–186; V.-A. 44–67; isth.-A. 86–116; body depth 74–108; 1D.–2D. 57–107; 1D. 76–102; 1P. 50–74; V. 77–133 (usually more than 100).

DESCRIPTION.—Head short, compressed and deep, width about equal to distance between snout tip and hind edge of orbit; length about 6 in total length. Body deep, compressed, width across pectoral bases about 2 in greatest depth (under first dorsal origin); body tapers rapidly behind anal origin. Orbits large, round to somewhat oval in outline, diameter more than snout, about 1.4–1.5 into postorbital, upper anterior margin flush with dorsal profile. Snout rather short but prominently pointed, its tip and lateral angles accentuated by large, spiny, tuberculous scales; width across lateral angles of snout more than inter-

TABLE 6. Gill Raker Counts for Three Populations of *Coryphaenoides serrulatus*.

	Total gill rakers, first arch									
	Outer series					Inner series				
	7	8	9	10	11	11	12	13	14	15
Indian Ocean	—	9	20	14	3	—	2	12	30	2
Australian Bight	5	16	17	—	—	2	14	11	1	—
New Zealand	2	6	—	2	—	—	1	9	—	—

	Total gill rakers, second arch											
	Outer series						Inner series					
	10	11	12	13	14	15	10	11	12	13	14	15
Indian Ocean	—	—	9	11	30	10	1	1	3	18	14	2
Australian Bight	2	3	9	11	3	—	1	8	14	4	1	—
New Zealand	—	—	1	8	1	—	—	—	8	2	—	—

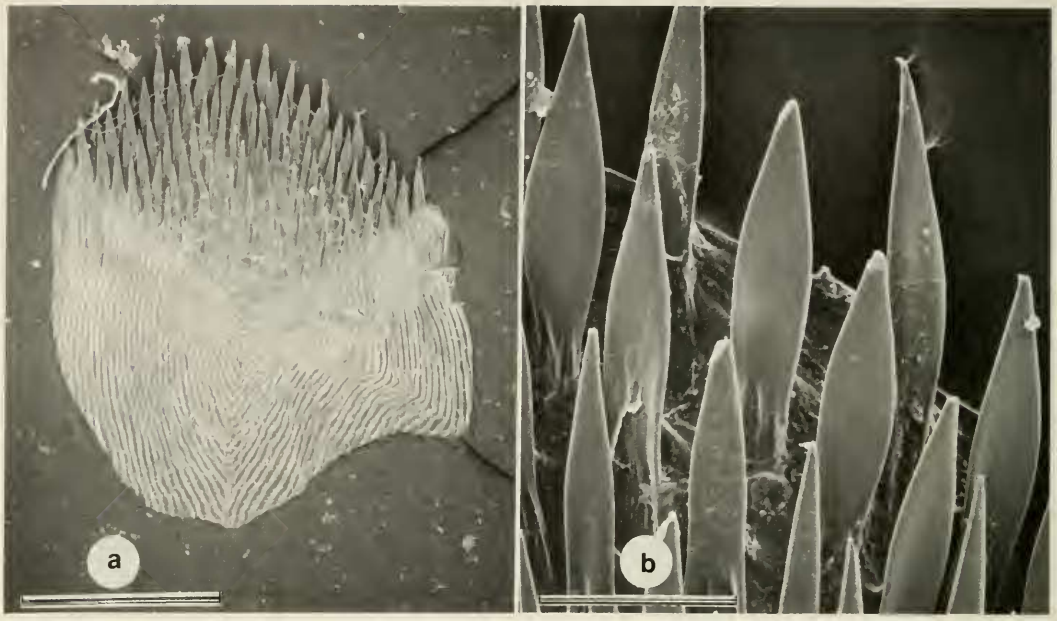

FIGURE 12. Scale from dorsum below interspace between first and second dorsal fins of *Coryphaenoides serrulatus oceanus* (CAS 66481). Scale bar in (*a*) equals 1.0 mm; that in (*b*) equals 0.15 mm.

orbital width, but least width across lateral nasal ridges (internasal width) much less than interorbital width. Mouth large, subterminal, upper jaw extends posteriorly just short of vertical through hind edge of orbit, rictus to below midorbit or beyond. Barbel very slender, tapering to hair-fine tip. Plane of suborbital almost vertical, but area traversed by a stout ridge extending from below anterior nostril to below hind border of orbit. Preopercle margin slightly lobed posteroventrally, with a slight inflection above angle, the ridge closely paralleling free edge. Interopercle rather broad, its tip exposed beyond preopercle. Cephalic sensory pores well developed, especially along ventral margin of suborbital, margin of preopercle, and on mandibular rami, and to a lesser degree along postorbital ridge and over interorbital.

Gill openings wide, extending forward to below end of maxillary; a narrow free posterior fold across isthmus. Outer gill slit moderately restricted; outer rakers on first arch numerous and developed into flat, tablike structures, the free distal tips bristling with small spinules, inner rakers somewhat more ridgelike, with proportionately less free margins; gill filaments relatively short, their greatest free length about equal to or more than length posterior nostril.

Scales on body (Fig. 12) large and densely covered with small, sharp, greatly reclined lanceolate spinules. Head scales more variable, those ventrally and over surfaces of interorbital, snout, and suborbital smaller; the large terminal and lateral snout scutes bluntly conical with multiple rows of stout spines radiating from apex; gap between these scutes and between lateral scutes and suborbital ridge covered with small, loose scales; suborbital ridge marked with a row of strong, thickened, coarsely spined scales; a second or third row of smaller, thickened scales above, forming ventral edge of orbit. Underside of snout, suborbital, and lower jaw covered with small, rather deciduous scales, the loss of which may suggest nakedness in these areas, especially under tip of snout.

Teeth in premaxillary in a moderately wide band, the inner teeth small and flanked externally by large, recurved conical teeth having flanged, arrowhead-shaped tips. Mandibular teeth slightly smaller than outer teeth of premaxillary and aligned in a uniform single row except at symphysis, where they stand in two rows.

Dorsal fin with a strong, laterally compressed spine, the leading edge armed with small, sharp, tightly spaced, imbricate teeth, the spine terminating in a short filament. Outer pelvic ray slen-

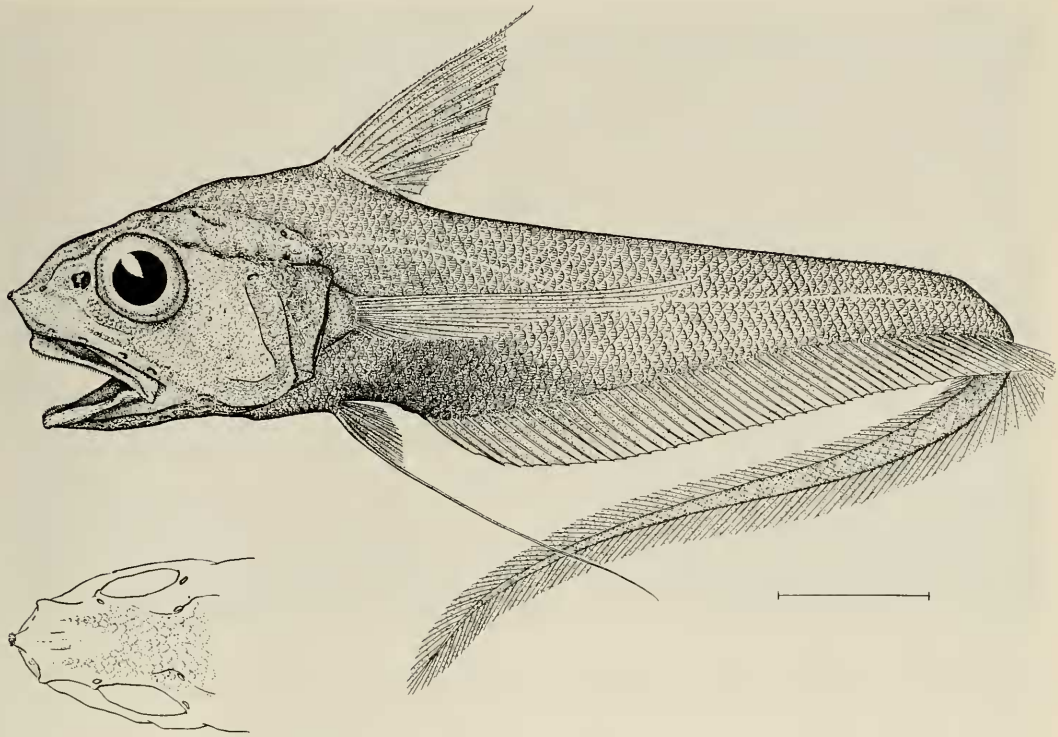

FIGURE 13. *Coryphaenoides mcmillani* n. sp. Holotype, NMV A.6794 (54.0 mm HL, 285+ mm TL), from off New South Wales, Australia, in 1,009–817 m. Scale bar equals 25 mm. Fins and scales partially reconstructed.

der, produced into a hair-fine filamentous tip that, if complete, extends beyond base of 10th anal ray. Pelvic and pectoral origins about on same vertical, slightly in front of first dorsal origin. Anal origin slightly behind vertical of hind end of first dorsal fin base. Origin of rudimentary second dorsal fin far posterior, often obscure.

Vent encircled by a black margin, which is broadened anteriorly and highly suggestive of a luminescent organ, but structure not histologically examined. Pyloric caeca long, slender, about equal to orbit diameter, directed posteriorly and ventrally; 14–23 in 27 specimens. Five or 6 retia mirabilia in 3 specimens. Stomach and intestinal tract of 38 specimens examined during *Vityaz*' cruise 17 contained only pelagic animals (determined by T. A. Gorelova, IOAN): decapods, amphipods, cephalopods, and mesopelagic fishes (*Argyropelecus* sp., *Stomias* sp., *Maurolicus muelleri*).

Color in alcohol medium gray-brown with a distinct underlying violet hue overall; surface over abdominal and gill cavities bluish to blackish. Gill membranes, snout, and underside of head often irregularly peppered with small melanophores, giving a dirty appearance; underside of snout above symphysis of jaws often blackish. Lips, fins (except second dorsal and basal portion of outer pelvic ray), rim of orbit, and anterior edge of posterior nostril blackish, the last two areas variably pigmented, however, Linings of mouth and gill cavity black; gill arches and rakers dusky.

DISTRIBUTION.—Indian Ocean, from Walters Shoals south of Madagascar to Broken Ridge (West Australian Ridge) (Fig. 10), in depths of 870–1,255 m.

SIZE.—To more than 48 cm.

ETYMOLOGY.—The subspecific name alludes to the oceanic distribution of the subspecies, compared with the more continental distribution of the nominate subspecies.

Coryphaenoides mcmillani new species
(Figs. 13–15)

TABLE 7. Selected Measurements of 13 Specimens of *Coryphaenoides mcmillani*. Asterisk indicates holotype.

	ZMMGU 17642	NMNZ J10/9/84	NMNZ J7/40/83	CAS 73236	NMNZ J10/9/84	NMV A.4277	NMNZ J10/9/84	NMNZ J10/9/84	NMV A.6794*	NMNZ J7/40/83	NMNZ A1/57/83	NMNZ J7/40/83	NMV A.6893
TL (mm)	207+	248	221	225+	223+	233	334	243+	285+	302+	325	320	273+
HL (mm)	40.5	41.6	41.8	44.6	49.0	50.7	51.2	53.8	54.0	55.2	55.9	56.1	56.4
The following in percent of head length													
Snout	28.4	30.0	29.4	28.7	30.4	31.2	29.1	29.7	29.8	28.1	28.1	29.8	29.1
Preoral	13.8	13.9	12.9	12.8	13.5	12.6	13.7	12.8	12.2	12.5	11.8	13.9	11.9
Internas.	20.0	22.8	20.3	23.1	22.7	20.7	22.3	21.0	22.0	21.9	21.3	20.1	21.5
Interorb.	25.7	26.4	26.3	28.0	28.8	26.4	30.3	28.6	26.7	27.2	27.7	26.4	26.8
Orbit	30.1	27.9	29.9	30.5	27.6	27.8	27.0	27.6	27.2	29.5	28.8	27.5	26.6
Suborb.	11.4	12.5	12.7	12.3	12.7	10.7	12.9	12.2	12.4	12.1	11.4	11.8	11.2
Postorb.	47.4	47.4	45.5	47.3	47.6	47.1	47.7	47.3	47.8	46.9	48.3	47.1	47.9
Orb-preop.	43.5	45.9	41.4	43.9	45.1	49.2	45.5	43.6	45.4	44.0	44.4	45.6	44.1
Up. jaw	49.9	47.1	46.2	49.8	47.3	46.4	46.3	46.4	47.4	46.6	47.4	48.1	46.3
Gill slit	25.2	22.8	23.2	26.5	22.7	23.3	21.5	21.0	20.4	24.1	22.9	23.2	22.7

DIAGNOSIS.—Snout naked except for small spiny scutes at terminal and lateral angles; head pores prominent; orbit 26.6–30.5% HL, internasal 20.0–23.1%, interorbital 25.7–30.3%, suborbital 10.7–12.2%; barbel rudimentary; pelvic fin rays 8 (rarely 9), length outer ray usually more than 100% HL; pectoral fin rays i17–i20 (rarely i16), length usually about 70–90% HL; inner gill rakers on first arch 16–18 (rarely 19); spinules on body scales thin, needlelike.

MATERIAL EXAMINED.—Holotype: NMV A6794 (♂, 54.0 mm HL, 285+ mm TL); Australia, New South Wales, 56 km ENE of Nowra, 34°44′S, 151°14.3′E; 1,009–817 m. Paratypes: Australia. NMV A4277 (50.7 HL, 233 TL); South Australia off Kingston, 37°36′S, 139°00′E; 1,060 m. NMV A6893 (56.4 HL, 273+ TL); Tasmania, 41 km NE of Cape Tourville, 41°54.5′S, 148°42.6′E; 1,273–119 m. **Central and western Indian Ocean.** ZMMGU P-17642 (40.5 HL, 207+ TL); Broken Ridge: West Australian Ridge, 30°50′S, 92°29′E; 1,400 m; *Prof. Mesiatzev* cr. 7, tr. 24; 1.IV.1979. CAS 73236 (44.6 HL, 225+ TL); Walters Shoals, 33°01.6′S, 44°49.2′E; 1,100–1,090 m, *Vityaz'* cr. 17, sta. 2670; 8–9.XII.1988. IOAN (32+ HL, 166+ TL); 32°53′S, 45°11′05″E; 1,210–1,265 m; *Vityaz'* cr. 17; 9.XII.1988. **South Atlantic.** ZMMGU P-17643 (34 HL, 180 TL) and ZMMGU P-14363 (59.1 HL, 338+ TL); off Cape Point, 35°48′S, 19°16′E; 950–1,000 m; *Fiolent* cr. 5, tr. 82; 8.XI.1974. IOAN (45 HL, 261 TL); Whale Ridge, 31°46′S, 02°10′E; 110 m; *Ikthyandr* tr. 72; 15.III.1987. **New Zealand.** NMNZ P.26958 (3, 41.8–56.1 HL, 221–320 TL); Challenger Plateau, 42°58.6′S, 168°21.9; 1,142–1,147 m; bottom trawl; sta. J7/40/83; 9.VII.1983. NMNZ P.26957 (55.9 HL, 325 TL); Challenger Plateau, 41°25.3′S, 168°05.2′E; 1,138–1,141 m; bottom trawl; sta. A1/57/83. NMNZ P.26956 (4, 41.6–53.8 HL, 223+–334 TL); Chatham Rise, 44°49.8′S, 172°48.5′E; 1,180–1,184 m; sta. J10/9/84; 9.VI.1984. NMNZ P.26959 (55.1 HL, 338 TL); Chatham Rise, 44°52.1′S, 175°24.4′E; 1,068–1,085 m; sta. J9/7/85; 7.V.1985.

COUNTS AND MEASUREMENTS (see also Table 7).—D. II,9–11 + about 125; V. 8 (rarely 9); scales below 1D. 7.5–9.0; below mid-1D. 4.5–6.5 (usually 5–6); below 2D. 6.5–9.5; lat.l. 31–36 (usually 31–34); caeca 9–10.

Total length 180–338 mm, HL about 34–56.1 mm. The following in percent HL: postrostral 72.2–74.6; posterior nostril 6.4–7.8; pre-A. 135–159; V.-A. 30–53; isth.-A. 65–93; body depth 68–85; 1D.–2D. 23–58; 1D. 73–94; 1P. 63–99; V. about 125–146.

DESCRIPTION.—Head short, moderately compressed, width slightly more than postorbital, length about 5–6 in total length. Body width across pectoral bases about 2 in greatest depth; dorsal profile tapers sharply below first dorsal, then levels off to end of tail. Snout bluntly pointed, scarcely produced beyond the large mouth, its

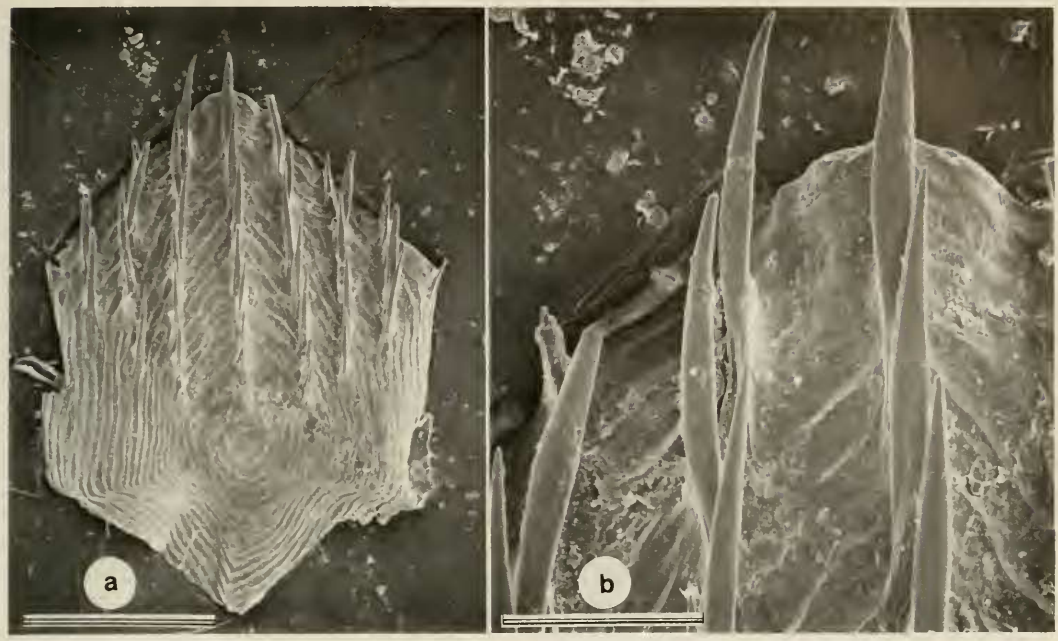

FIGURE 14. Scale from dorsum below interspace between first and second dorsal fins of *Coryphaenoides mcmillani* (NMNZ J10/9/87). Scale bar in (*a*) equals 0.75 mm; that in (*b*) equals 0.15 mm.

width across lateral angles about equal to least interorbital width, tipped with a small, button-like spiny scute, the apex of which is directed anterodorsally; smaller scutes at each lateral angle. Orbit round to somewhat oblate, the anterodorsal margin scarcely if at all entering dorsal profile; its greatest diameter about equal to least interorbital width. Mouth large, upper jaw extends posteriorly to below hind edge of orbit, rictus to midorbit or beyond. Barbel a tiny stump, scarcely developed.

Suborbital with a narrow, almost vertical shelf, least width about half of orbit diameter, half of interorbital width. Preopercle margin slightly lobed posteroventrally, the preopercle ridge notably more angular. Interopercle narrow, its posterior tip minimally exposed beyond preopercle margin. Cephalic sensory pores large, well developed, particularly on mandibular ramus, along lower margin of subopercle, and along dorsal edge of postorbital ridge.

Gill openings wide, extending forward to under posterior end of maxillary; gill membranes narrowly attached to isthmus, with a broad free fold. Outer gill slit moderately restricted, the opening slightly less than internasal width. Outer series of rakers on first arch relatively long, flat, from broadly triangular ventrally on arch to saber-shaped in dorsalmost ceratobranchial rakers; inner margin beset with small sharp spines. Rakers on inner series of first arch and in other arches generally shaped somewhat like short, laterally flattened, wide-based clubs, the distal margin of the "clubhead" bristling with sharp needlelike spines. Gill filaments short, their length about equal to length of longest outer gill rakers.

Scales highly deciduous, most relatively small, those on body below anterior end of second dorsal fin covered with extremely thin, needlelike, strongly recurved spinules arranged in approximately 8–10 almost parallel rows (Fig. 14). The terminal and lateral snout scutes rather small, each isolated around a broad region of naked skin, the naked surfaces of snout extending dorsad along broad avenues on medial sides of internasal ridges, interrupted on each side by a narrow peninsula of small scales projecting forward along either side of supranarial ridge. Lateroventrally the naked surfaces extend below suborbital shelf to near posterior end of upper jaw, although a narrow wedge of small scales extends forward to below nostrils. Mandibular

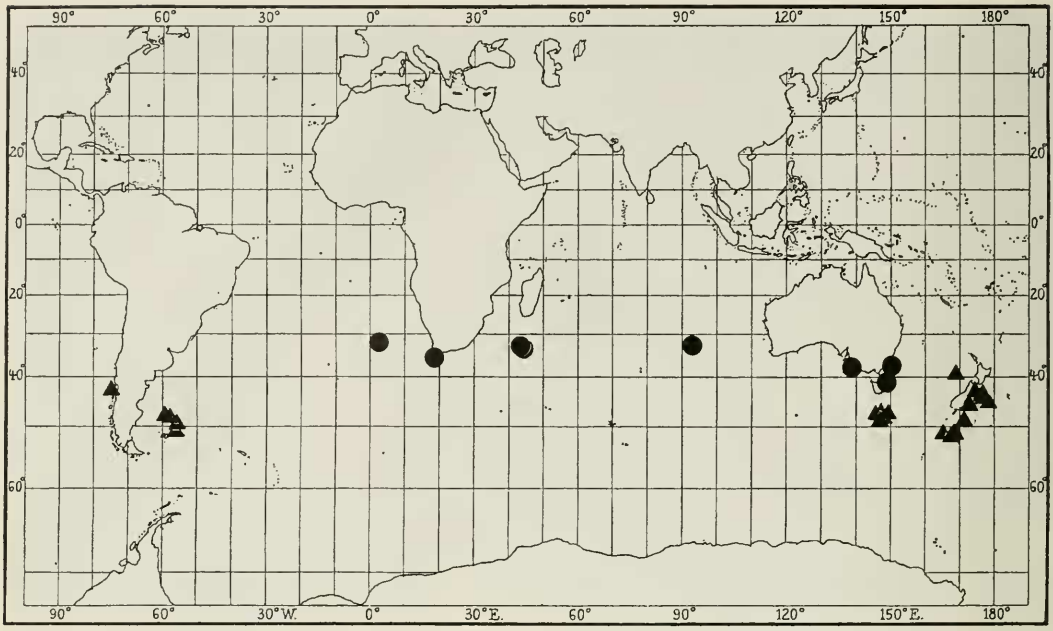

FIGURE 15. Catches of *Coryphaenoides mcmillani* (circles) and *C. subserrulatus* (triangles). Southwest Atlantic plots of *C. subserrulatus* after Trunov and Konstantinov (1985).

rami have single file of small, loose scales. Scales along suborbital shelf small, not especially stout, only 1 or 2 rows deep.

Teeth in premaxillary in a narrow band with a close-set outer series of slightly enlarged teeth. Mandibular teeth small, in an irregular row laterally, in a narrow cluster at symphysis. A distinct gap at symphysis separating left and right tooth bands of both jaws.

First dorsal fin with a sharp spikelike first spinous ray followed by a long compressed ray armed with a sharp ridge of small serrations along leading edge; fin base rather steeply inclined; fin origin about on same vertical as that of pectoral fin, or slightly behind. Second dorsal fin rudimentary over anterior half or so; origin difficult to determine in some specimens because anteriormost rays rudimentary. Pectoral fins long, when intact almost as long as head; upper middle rays longest, distally hairlike and easily broken. Pelvic fin with an elongated outer ray that exceeds length of head in almost all specimens (those shorter probably a result of having been broken off); fin origin under hind edge of operculum, slightly ahead of pectoral origin. Anal fin well developed, although distal tips of rays weak and easily broken; origin under posterior edge of first dorsal fin or somewhat more posterior.

Vent situated immediately anterior to anal fin origin; no trace of a luminescent organ in CAS paratype, although abdomen between pelvic and anal fins black. Peritoneum ivory but overlain by black pigmentation. Pyloric caeca short, fat, directed generally ventrally; 9, 9, 10, and 10 counted in 4 paratypes. Intestinal bending pattern simple in a NMNZ specimen (41.6 HL), with two major bends between pylorus and anus, and a small "S" bend near rectal end. A 55.2 mm HL female (NMNZ) had large ovaries with well-developed eggs ranging 0.6–1.2 mm diameter. Swim bladder of ZMMGU P-14363 (♀, 59.1 mm HL) well developed; five slender short retia attached to small, bean-shaped gas glands. Stomach in this specimen packed with shrimplike crustaceans.

Color in alcohol brownish gray to swarthy overall, with pronounced blackish area over abdomen behind pelvic fins and extending posteriorly to over first several anal fin rays. Margins of scale pockets darkly marked in denuded specimens. Operculum and branchiostegal membranes black. Most of head membranes blackish

and thinly covered with small melanophores. Jaws dark gray to blackish. A narrow black orbital ring. Fins dusky to blackish, first dorsal and pelvic fins generally darkest. Linings of mouth and gill cavities black. Gill arches and rakers dark gray.

Distribution (Fig. 15).—Whale Ridge and tip of South Africa in Atlantic, west through southern Indian Ocean and South Pacific to New Zealand. Depth range 950–1,400 m.

Etymology.—Named after Peter McMillan of the Fishery Research Agency in Wellington, New Zealand, who independently recognized the species as new and was planning to describe it as such, but kindly deferred to us and allowed us to study his material.

Remarks and Comparisons.—*Coryphaenoides mcmillani* is very similar to *C. subserrulatus* and was mistakenly identified as that species by Shcherbachev (1987). On initial examination, the first specimen we examined from Broken Ridge appeared to be simply a darker, damaged representative of *C. subserrulatus*. Closer study, however, revealed pronounced differences in lengths and counts of pelvic and pectoral fin rays, and the size of several head parts. Subsequently, two badly damaged specimens were discovered in IOAN, and a fourth specimen was taken by the *Vityaz'* off Walters Shoals in 1988. In November 1989, one of us (TI) discovered three relatively undamaged southern Australian specimens in the collections of the NMV, and Peter McMillan had nine New Zealand representatives. Surprisingly, no specimens were found in the extensive collections of the Australian Museum in Sydney.

The new species shares with *C. subserrulatus* a similar head and body morphology, with a large subterminal mouth, short, blunt snout tipped with a prominent terminal scute that is directed anterodorsally, high gill raker counts, relatively long outer gill rakers on first arch, elongated outer pelvic fin, rudimentary barbel, and similar dentition. The new species differs notably in lacking the elongated pectoral fin ray of *C. subserrulatus*, in having needlelike spinules on body scales (cf. leaflike), a substantially broader suborbital, somewhat shorter preoral length and orbit diameter, and somewhat greater snout length, internasal width, interorbital width, postorbital length, and length orbit to angle of preopercle. *Coryphaenoides mcmillani* is also a darker fish overall, the region around the mouth and gill membranes being notably darker than in *C. subserrulatus*.

The new species is readily distinguished from *C. serrulatus* by its elongated outer pelvic fin ray, its rudimentary chin barbel (well developed in *C. serrulatus*), its deciduous scales that have needlelike spinules (relatively adherent scales densely covered with leaflike spinules in *C. serrulatus*), its extensive naked areas on the snout (vs. mostly scale covered), and its anterodorsally directed terminal snout scute (vs. anteriorly directed).

Coryphaenoides mcmillani and *C. subserrulatus* are apparently sympatric off New Zealand, southeastern Australia and Tasmania, and possibly also off southern Africa (two specimens of the latter species recorded by Iwamoto [1986] must be rechecked). Specimens of *C. subserrulatus* have been captured much shallower than specimens of the new species, but at greater depths the depth distributions overlap. Surprisingly, *C. subserrulatus* has not been recorded from oceanic elevations of the Indian Ocean far from continental influences, and the species appears to be entirely replaced there by *C. mcmillani*.

Coryphaenoides subserrulatus Makushok, 1976
(Figs. 15–17)

Coryphaenoides subserrulatus Makushok, 1976:144–155, figs. 1–7 (holotype ZIN 42639A plus 5 paratypes, S of New Zealand off Campbell Plateau; 52°20'S, 166°13'E; 1,148–1,180 m). Ayling and Cox 1982:166. Last et al. 1983:243–244, Fig. 21.18 (recorded off Australia [Tasmania and Victoria], apparently common off Tasmania in 900–1,050 m). Trunov and Konstantinov 1985:153–155 (recorded off SE coast of South America; 730–860 m; description, slight differences in morphometry found between Atlantic and New Zealand specimens). Iwamoto 1986:335, Fig. 93.13 (2 spec. off South Africa [Agulhas Bank]; 980 m). Pavlov and Andrianov 1986: 158–159 (28 spec., recorded from Mill submarine elevation [South Tasman Rise]). Paxton et al. 1989:326 (listed; recorded off SE Australia [New South Wales, Tasmania, Victoria]).

Coryphaenoides (*Coryphaenoides*) *quadripennatus* McCann and McKnight, 1980:41–42, Figs. 18, 21–23 (holotype NZOI 190, plus 8 paratypes; all from New Zealand area, 739–1,212 m).

Diagnosis.—Pelvic fin rays 7, the outer stout greatly elongated, usually more than 1.5 times length of head; pectoral fin rays i13–i18 (usually i14–i15), second uppermost ray stout and greatly elongated, much longer than head length; inner gill rakers on first arch 16–19; chin barbel rudimentary, scarcely visible; spinules on body scales lanceolate to shield-shaped (Fig. 17).

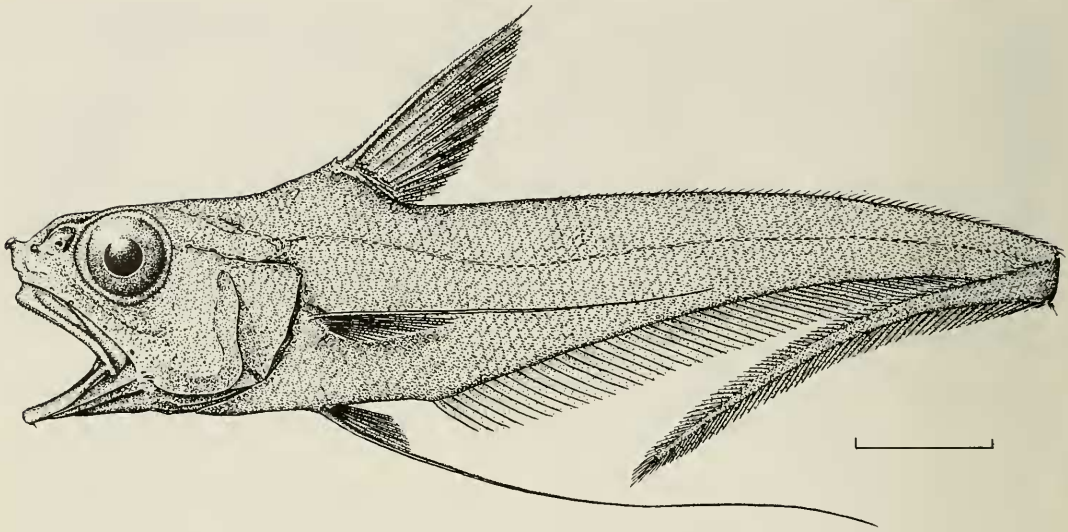

FIGURE 16. *Coryphaenoides subserrulatus.* LACM 11485-1 (310 mm TL) collected by the *Eltanin* off New Zealand (43°48.2′S, 174°24′W) in 497 fm (909 m). Scale bar equals 25 mm. Fins and scales partly reconstructed.

MATERIAL EXAMINED (58 spec.).—South Tasman Rise [Mill submarine elevation]: ZMMGU P-16266 (19, 34.8–60.2 HL, 210–340 TL); 47°27′S, 148°26′E, *Prof. Mesiatzev* cr. 12, tr. 39; 27.IV.1983. LACM 11449-5 (2, 56.0–57.5 HL, 339–320 TL); 47°11′S, 147°47′E; 1,034 m; *Eltanin* sta. 1983; 24.II.1967. LACM 11447-1 (59 HL, 370 TL); 47°21′S, 147°52′E; 915 m; *Eltanin* sta. 1981; 24.II.1967. NMV A5029 (5, 52.6–63.0 HL, 314+–352 TL); 47°29.0′S, 147°59.0′E. ZMMGU P-16273 (9, 17.9–23.8 HL, 96–161+ TL); 47°17′S, 148°15′E; 900–920 m; *Prof. Mesiatzev* cr. 12, tr. 41; 28.IV.1983. ZMMGU P-16287 (26.2 HL, 140+ TL); 47°19′S, 148°22′E; 930 m; *Prof. Mesiatzev* cr. 12, tr. 40; 27.IV.1983.

New Zealand. LACM 11085-6 (8, 47–59 HL, 270–330 TL); Campbell Plateau, 53°49′S, 169°57.2′E; 971 m; *Eltanin* sta. 1990; 1.I.1968. IOAN (56.7 HL, 310 TL); Campbell Plateau, 48°55′S, 171°15′E; 680 m; *Poseidon* 85E. IOAN (52.5 HL, 300+ TL) and CAS 71485 (2, 47.4–49.8 HL, 280–292+ TL); Campbell Plateau, 53°20′S, 167°14′E; 1,020–1,026 m; *Dmitry Mendeleev* sta. 1281; 17.I.1976. IOAN (48.8 HL, 265 TL); Chatham Rise, 44°S, 178°05′E; 960 m; *Poseidon* 110E. CAS 71490 (58.9 HL, 350+ TL); Chatham Rise, 42°55′S, 177°09′E; 860 m; *Poseidon* 139E. IOAN (55.9 HL, 333 TL); Chatham Rise, 42°30′S, 175°E; 250–600 m; *Poseidon* 11E. IOAN (58.0 HL, 330 TL); Chatham Rise, 44°30′S, 177°39′E; 820 m; *Poseidon* 100E. IOAN (58.0 HL, 356 TL); Chatham Rise, 44°53′S, 173°11′E; 990–1,000 m; *Poseidon* 135E. CAS 71496 (54 HL, 305 TL); Norfolk Rise, 39°17′S, 167°02′E; 880 m; *Poseidon* 146E. IOAN (53.9 HL, 315 TL); *Poseidon* 112E. IOAN (46.1 HL, 250+ TL); *Poseidon* 265D.

South Atlantic. Off Argentina, IOAN (52.5 HL, 200+ TL; dried spec.); 47°25.5′S, 60°03′W; 790 m; *Gizhiga* tr. 213; 14.IX.1975. ZIN 48737 (2, 53.0–58.4 HL, 325–315+ TL); 47°17′S, 59°49.3′W; 825–830 m; *Patriot* tr. 225; 22.XI.1984. ZIN 48732 (52.3 HL, 290+ TL); 50°55′S, 56°05′W; 740–760 m; *Gizhiga* cr. 27, tr. 190; 22.VIII.1985.

Southeastern Pacific. Off Chile, ZIN 48715 (9, 56.8–65.3 HL, 287+–372 TL); 42°24.3′S, 74°45′W; 470–440 m; *Akademik Knipovich* cr. 12, sta. 128; 26.II.1973.

Other specimens not examined in detail; all South Tasman Rise: NMV A.5830 (148 TL); 47°00′S, 147°45′E. NMV A.3625 (1 spec.); 47°32′S, 148°16′E; 1,100 m. NMV A.5011 (4, 116–250 TL); 47°01′S, 148°04′E. NMV A.5831 (206 TL); 47°31′S, 148°30′E. NMV A.3621 (1 spec.); 47°29′S, 148°30′E; 1,056 m. NMV A.5029 (5, 312–348 TL); 47°29′S, 147°59′E. NMV A3708 (3, 310–330 TL).

COUNTS AND MEASUREMENTS.—D. II,9–11 + about 120–133; GR-I (outer) 10–14, GR-II (outer/inner) 16–18/14–17; scales below 1D. 8–9, below mid-1D. 4.5–6.5, below 2D. 6.5–8.5, lat.l. 29–37; caeca 12–14.

Total length 96+–370 mm, HL 17.8–63.0. The following in percent HL: postrostral 72.7–77.4; snout 25.0–29.4; preoral 10.0–13.9; internasal 16.3–19.5; post. nostril 5.5–8.6; interorbital 19.8–25.2; orbit 29.6–34.3; suborbital 7.3–9.6; postorbital 43.3–46.7; orb.-preop. 36.1–42.7; upper jaw 44.1–49.0; gill slit 20.5–26.7; pre-A. 143–175; V.-A. 33–51; isth.-A. 77–108; body depth 73–86; 1D.–2D. 40–79; 1D. height 81–96; 1P. 115–214; V. 158–221.

SIZE.—Attains at least 37 cm.

DISTRIBUTION.—New Zealand, South Tasman Rise, southeastern Australia off New South Wales and Victoria, Agulhas Plateau, the Atlantic off Argentina, and the southeastern Pacific off Chile. The species is apparently peripheral to the Indian Ocean, having been captured only at the extreme

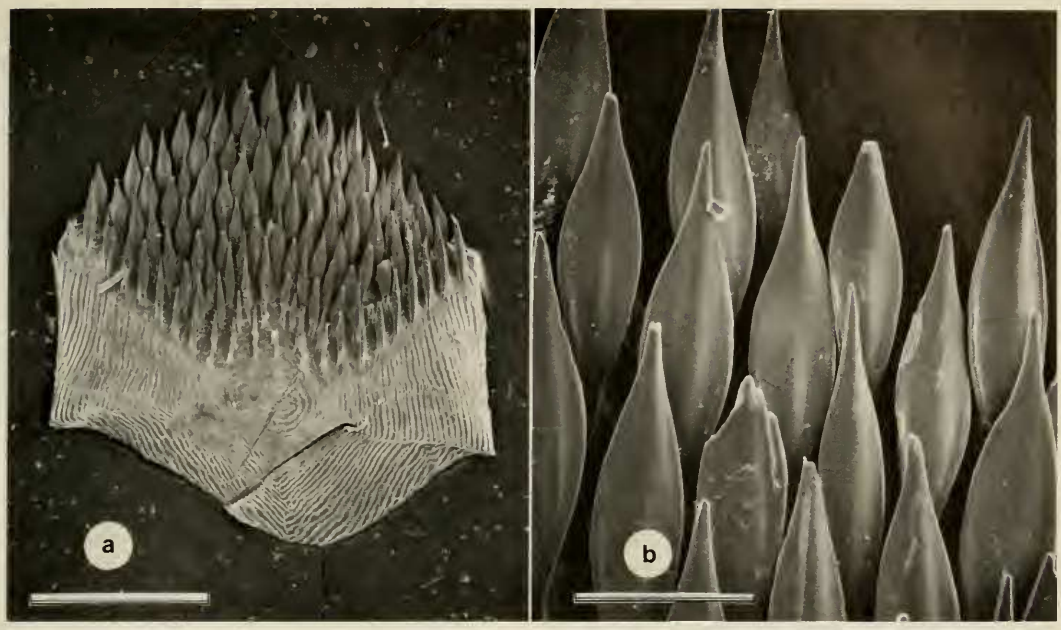

FIGURE 17. Scale from dorsum below interspace between first and second dorsal fins of *Coryphaenoides subserrulatus* (CAS 71485) from off New Zealand. Scale bar in (*a*) equals 1.0 mm; that in (*b*) equals 0.2 mm.

southeastern and southwestern borders. Shcherbachev's (1987:7) report of it from the Broken Ridge was based on a 205 mm specimen, described above as *C. mcmillani.* The presence of *C. subserrulatus* off the Atlantic coast of Argentina and the Pacific coast of Chile is surprising and creates quite a disjunction in the geographic distribution of the species. In reporting on their South Atlantic specimens, Trunov and Konstantinov (1985) noted several differences between their material and those from the New Zealand area. They attributed the differences to geography and habitat. In light of the discovery of a new Indian Ocean species related to *C. subserrulatus,* further examination of their material might be worthwhile.

REMARKS.—*Coryphaenoides subserrulatus* has been well described and illustrated by several workers (see synonymy), and another detailed description is unnecessary. This species is so distinctive that it is not likely to be confused with any other species except *C. mcmillani.* The two species, however, are readily distinguished by differences in pelvic fin ray numbers, the length and development of elongated pectoral fin ray, and several morphometric features, as described in the description of *C. mcmillani.*

DISCUSSION OF RELATIONSHIPS.—In their cladogram of *Coryphaenoides* and relatives, Iwamoto and Sazonov (1988: Fig. 1) had the *C. serrulatus* group on a branch with *Albatrossia* and *Hyomacrurus* based on the presence of only two retia mirabilia in the gas gland, compared with four or more in most *Coryphaenoides* and other closely related genera and species groups. The count of two retia in the *C. serrulatus* group was based on Trunov and Konstantinov's (1985) report of that number in two specimens of *C. subserrulatus.* Our subsequent examination of several specimens of *C. subserrulatus, C. serrulatus,* and *C. mcmillani* has shown six, a number that would place the group in the clade with subgenera *Chalinura, Lionurus,* and *Nematonurus.* We cannot account for the differences in counts between our findings and those of Trunov and Konstantinov; their specimens should be reexamined. Often, the individual retia and gas glands appear to be coalesed into one or two structures and must be teased apart to show the separate parts. Perhaps this was the situation in their specimens. The leaf-shaped scale spinules, initially thought to be a synapomorphy of the *C. serrulatus* group, are absent in *C. mcmillani.* The needlelike scale spinules of that species probably

represent a plesiomorphic condition, similar to the condition in other members of the subgenus *Chalinura.* Based primarily on dentition and gill raker shape, the *C. serrulatus* group most closely agrees with subgenus *Chalinura,* but our assignment is tentative and awaits confirmation or contradiction from other sources.

Trunov and Konstantinov's (1985) report of the presence of a small light organ immediately anterior to the anus of *C. subserrulatus* marks the first record of such a gland in a species of *Coryphaenoides,* although light organs are common to all *Coelorinchus* species and three other genera with six branchiostegal rays. (All macrourines with seven branchiostegal rays appear to have light organs.) We interpret its presence as a retention of a plesiomorphic state common in the Malacocephalini, as well as in members of *Coelorinchus,* but secondarily lost in *Coryphaenoides.* It would be well to examine histologically other members of *Coryphaenoides* to determine if light organs are represented more widely than currently assumed.

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